Faculty of Electrical and Electronic Engineering Technology

ANALYSIS OF LIGHTING SYSTEM EFFICIENCY USING DIALUX SOFTWARE FOR INDUSTRIAL LABS

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Bachelor of Technology in Electronic Industrial Automation with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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I declare that this project report entitled Analysis Of Light System Efficiency Using Dialux Software For Industrial labs is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in the andidature of any other degree.

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I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours. (please change the red text into black after edited)

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DEDICATION

This project is dedicated to my parents who have never failed to give me financial and moral support, for giving all my needs during the time I developed the system, and for teaching me that even the largest task can be accomplished if it is done one step at a time.

I dedicate this Project to all the people who have worked hard to help me complete this project.

This project is especially dedicated to my supervisor who helped and guided me to successfully complete this project work.

ABSTRACT

Certain labs in FTKEE face insufficient lux reading as required by the Malaysia Standard MS1525. The objective of the project is to do the simulation to achieve the best lighting layout, type of lighting, and minimum annual power consumption. AutoCAD software will be used to draft the layout and size of the labs. Based on the draft layout, DIALux software will be used the create the simulation to produce the lux reading and power consumption result and analysis. The result and analysis will be used to determine the best lighting layout, type of lighting, and minimum annual power consumption. The project will be focused on industrial automation labs, such as Robotic Labs, FMS lab, and Pneumatic & Hydraulic lab

ABSTRAK

Makmal tertentu di FTKEE menghadapi bacaan lux yang tidak mencukupi seperti yang dikehendaki oleh Malaysia Standard MS1525. Objektif projek adalah untuk melakukan simulasi untuk mencapai susun atur pencahayaan terbaik, jenis pencahayaan dan penggunaan kuasa tahunan minimum. Perisian AutoCAD akan digunakan untuk merangka susun atur dan saiz makmal. Berdasarkan reka letak draf, perisian DIALux akan digunakan untuk mencipta simulasi untuk menghasilkan bacaan lux dan hasil dan analisis penggunaan kuasa. Hasil dan analisis akan digunakan untuk menentukan susun atur pencahayaan terbaik, jenis pencahayaan dan penggunaan kuasa tahunan minimum. Projek ini akan tertumpu pada makmal automasi industri, seperti Makmal Robotik, makmal FMS, dan makmal Pneumatik & Hidraulik

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INTRODUCTION

1.1 Background

Certain labs in FTKEE face insufficient lux reading as required by the Malaysia Standard MS1525. The objective of the project is to do the simulation to achieve the best lighting layout, type of lighting, and minimum annual power consumption. AutoCAD software will be used to draft the layout and size of the labs. Based on the draft layout, DIALux software will be used the create the simulation to produce the lux reading and power consumption result and analysis. The result and analysis will be used to determine the best lighting layout, type of lighting, and minimum annual power consumption. The project will be focused on industrial automation labs, such as Robotic Labs, FMS lab, and Pneumatic & Hydraulic lab

1.2 Problem Statement

Certain Automation Labs at FTKEE have insufficient lux reading because of the unsuitable lighting layouts. Lighting layouts are very important to get the best lighting in the labs. Thus, this project is intended to get the best layout of the Automation Labs according to the Malaysian Standard MS1525. This project also aims to minimize the annual power consumption by identifying the best type of lighting to be used in the labs.

1.3 Project Objective

I. Design layouts of labs using AutoCAD software to get the accurate design of labs.
II. Analyzes lux and power consumption of labs using DIALux software.
III. Propose lighting arrangement and choose the suitable type of lighting to meet the illuminance level (lux) and lighting density required by the Malaysian Standard MS1525 energy-efficiencies lighting system.

1.4 Scope Of Project

Analysis of lighting system efficiency mainly depends on software. Two software will be used which are AutoCAD and DIALux. AutoCAD will be used to design the layouts of the labs while DIALux software will be used to calculate the lux, power efficiency and the type of lighting to be used.

1.5 Research Methodology

There are a variety of methods that can be used to complete this project. Before proceeding with the project, it is necessary to determine the software that will be used to analyze the lux in the labs and to keep the project as basic as possible while still achieving the project's goal. The first step in this project is to visit all the automation labs that are required to be analyzed. It is important to self-analyze the structure and the layouts of lighting in each lab. Next, the distance of the existing light layouts has to be measured using a laser measurement tool to do the draft layouts of the lights in the labs. AutoCAD software comes in to design the layouts of the Automation Labs. Without the design of the labs through AutoCAD, it will be quite difficult to get an accurate reading of lux in the labs. Finally, DIALux software comes in to calculate the lux, power efficiency, and types of lights that can be used to minimize the power consumption.

1.6 Project Deliveries

This project will be designed to provide the best lux reading in automation labs at FTKEE and follow the Malaysia Standard MS1525, as well as better power consumption. Types of lighting best to be used will be obtained to minimize the annual power consumption and to obtain a precise analysis by using DIALux software.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

To determine the illumination from an electrical source, a variety of approaches can be utilised. The source of natural light and electric light sources are equal in terms of calculating illuminance on a surface or the luminaire of a surface. We used simulation work with DIAlux software and AutoCAD software in this investigation. The following information must be acquired in advance to design the lighting systems in a building: room length (L), room width (W), ceiling height (Hc), suspension height (Hs), working plane height (Hw), surrounding the condition, and kind of room. Then, decide on the lighting style. Downlight lamps, fluorescent, incandescent lamps, current type, lamps type of industry, or lamp types for household use are examples of regularly used lighting. However, what matters is the light produced by the lights and how that light is delivered.

2.2 TYPES OF LAMP

2.2.1 FLUORESCENT LAMP

A fluorescent lamp is a light-weight mercury vapour lamp that emits visible light through fluorescence. During the discharge process, an electric current in the gas energises mercury vapour, which emits ultraviolet radiation, which causes the phosphor coating on the lamp's inner wall to emit visible light.

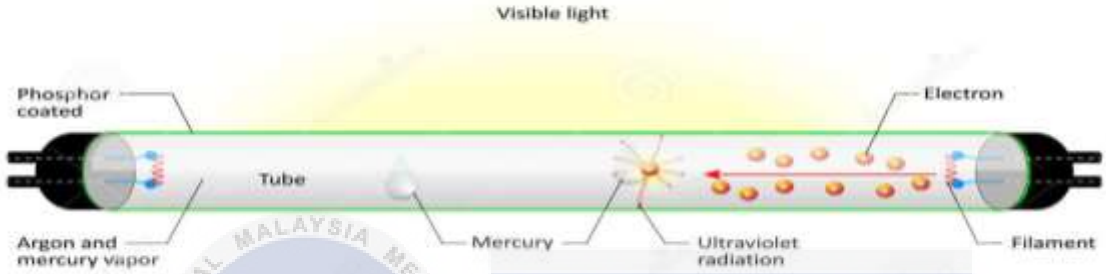


Figure 2.2.1: Fluorescent Tube

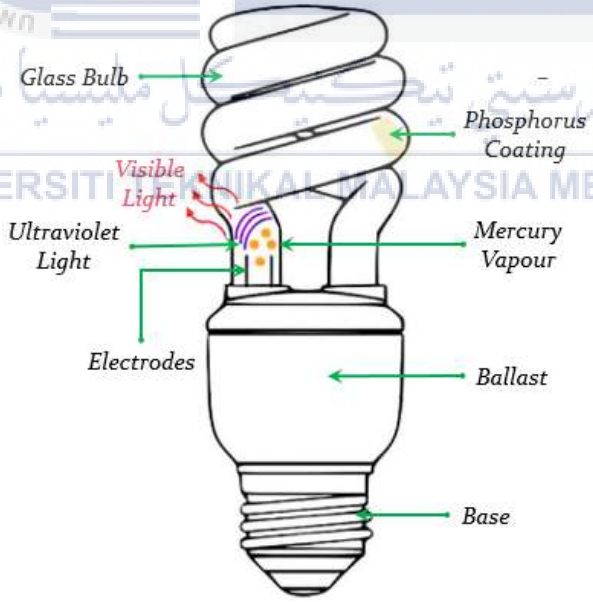


Figure 2.2.2: Compact Fluorescent Lamp (CFL)

In comparison to incandescent lights, fluorescent lamps convert electrical energy into useable light energy far more efficiently. Fluorescent lighting frameworks often have a luminous viability of 50 to 100 lumens per watt, which is many times the adequacy of incandescent lights with equal light produce.

Let's look at the circuit of a fluorescent lamp, also known as a tube light, before going into the operating concept of a fluorescent lamp.

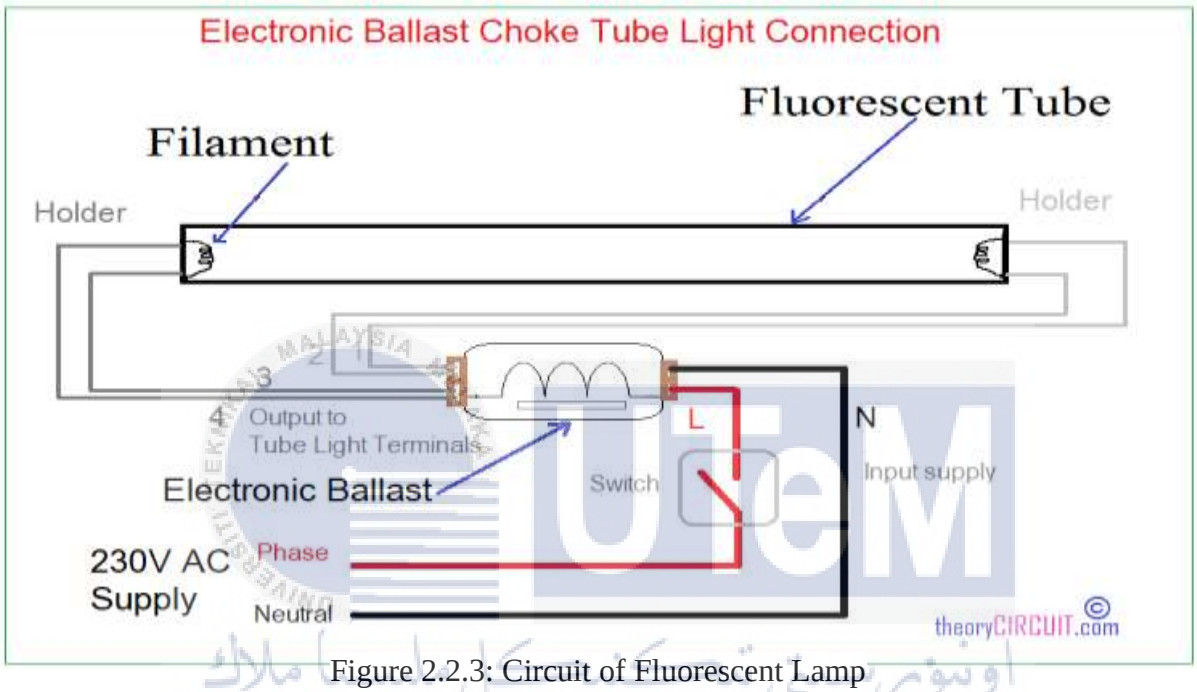


Figure 2.2.3: Circuit of Fluorescent Lamp

2.2.2 L.E.D

An LED light bulb is a solid-state lighting (SSL) device that employs LEDs (light-emitting diodes) to create light and fits in normal screw-in connectors.

In comparison to incandescent lights, LED light bulbs are more ecologically friendly. When an electric current travels through a semiconductor device, visible light is produced. Electroluminescence is the name for this characteristic. The most common incandescent bulb replacement, compact fluorescents, use electricity to excite mercury gas until it generates ultraviolet (UV) light. The light is then transmitted via a phosphor, which causes additional visible light to be emitted.

LEDs have been available for a while, but advancements in efficiency, cost, and output have only lately made them practical for larger-scale lighting in homes, companies, and other settings. Because of the fast advancement of LED technology, products with a broad variety of efficiency and life spans are now available.

If not used outside of the recommended temperature range, the bulbs can last for 50000 hours. They need 8-11 watts to replace a 60-watt incandescent with at least 806 lumen and 9.5 watts to replace a 75-watt equivalent. This capacity offers an efficiency boost of up to 80% over a bulb.

2.3 TYPES OF SOFTWARE

2.3.1 AUTOCAD

AutoCAD is a computer-aided drawing tool that may be used for a variety of design tasks. Its primary function is to allow users to sketch using electronic versions of traditional drafting equipment. Measurements and computations, 3D components, and data exchange are all aided by the addition of digital precision.

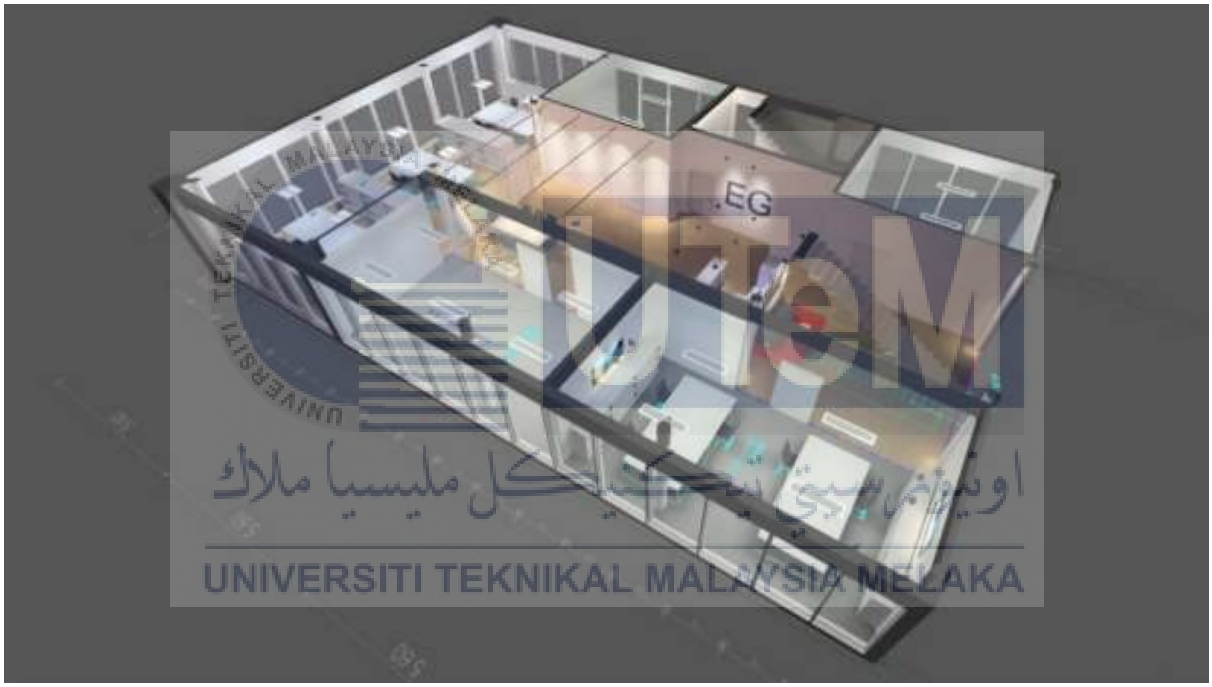
- Specialized toolsets: The parts of AutoCAD that contain industry-specific drafting tools, like AutoCAD Mechanical 3D and AutoCAD Raster Design, are only compatible with Windows.
- 3D mapping: A more generalized feature that helps anyone who designs in 3D, 3D mapping helps you place objects in your designed world. It's especially useful for those who use AutoCAD for interior design or other whole-space creations.

Users complain that AutoCAD is difficult to learn since its user interface is sophisticated and does not appear to be organised in a way that is intuitive to people who haven't used it before.

2.3.2 DIALUX

Lighting software, often known as lighting design simulation software, has proven to be incredibly valuable in the design of artificial lighting projects in recent years.

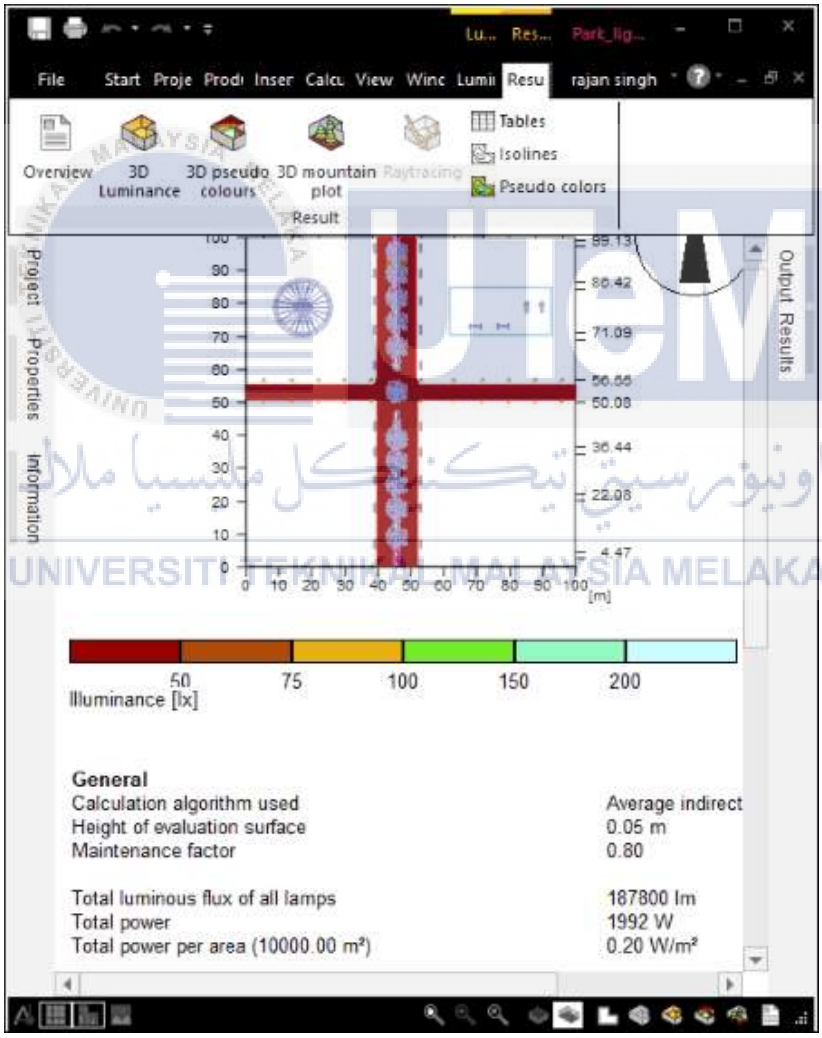
The designers' work is greatly aided by computer programmes, which perform the proper dimensioning and launch of the lighting system in a short amount of time, reconciling aspects of visualisation of luminometrically effects produced by artificial lighting to visual performance and energy efficiency criteria, allowing them to examine the impact of various project decisions.



2.3.3 OTHER LIGHTING SIMULATION SOFTWARE AVAILABLE

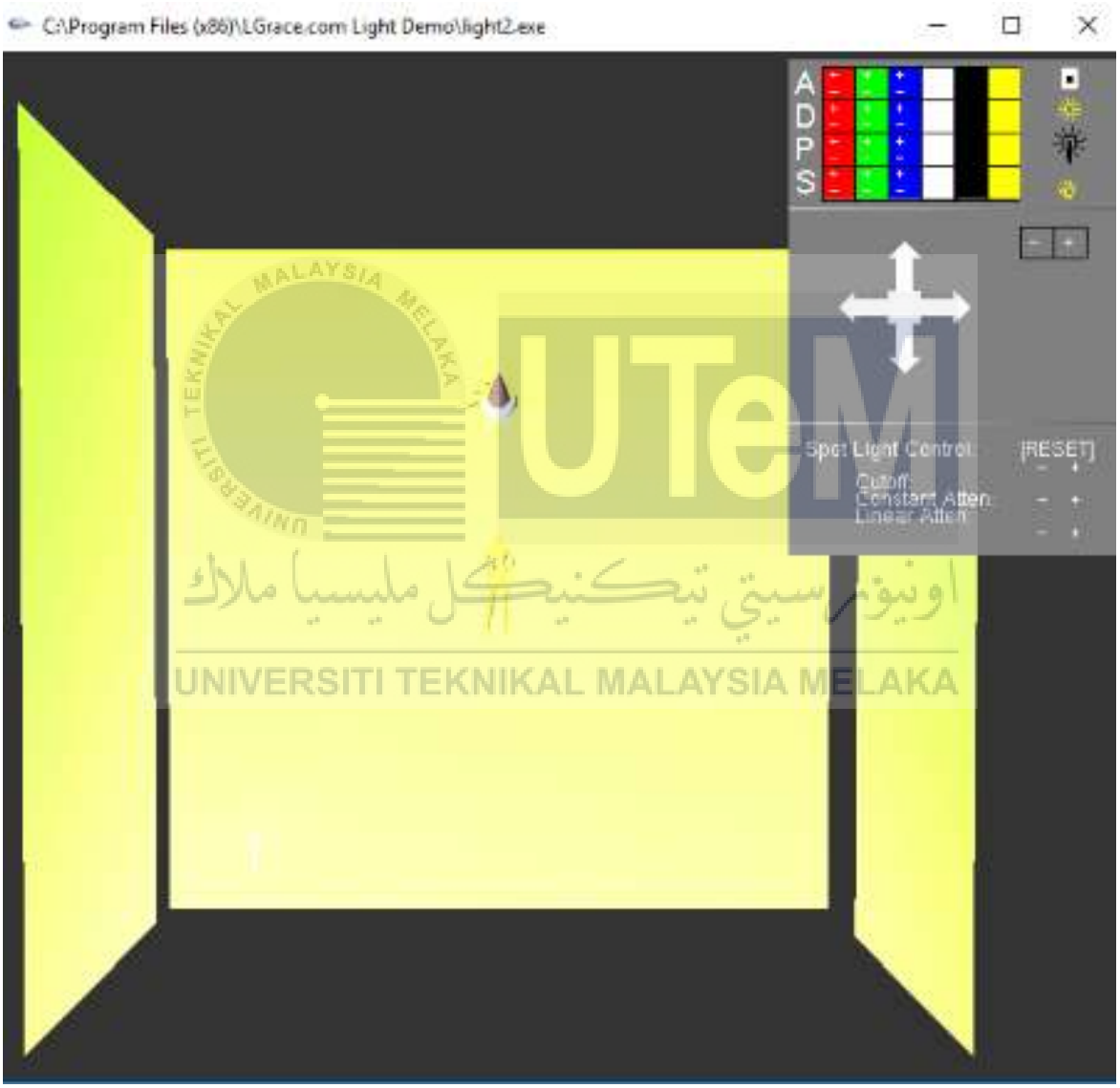
2.3.3.1 RELUX

Relux is a powerful tool for simulating artificial and natural light. It allows you to design and simulate lighting for both indoor and outdoor projects. You may make a variety of scenarios, such as an interior with CAD plan, an exterior with CAD plan, a road, a tunnel, an interior with a background image, an exterior with a background picture, and so on. You may add room items, outside objects, measurement objects, 3D objects, and more to a floor plan. You can choose a light product for Luminaire, Lamp, and Sensor for lighting study.



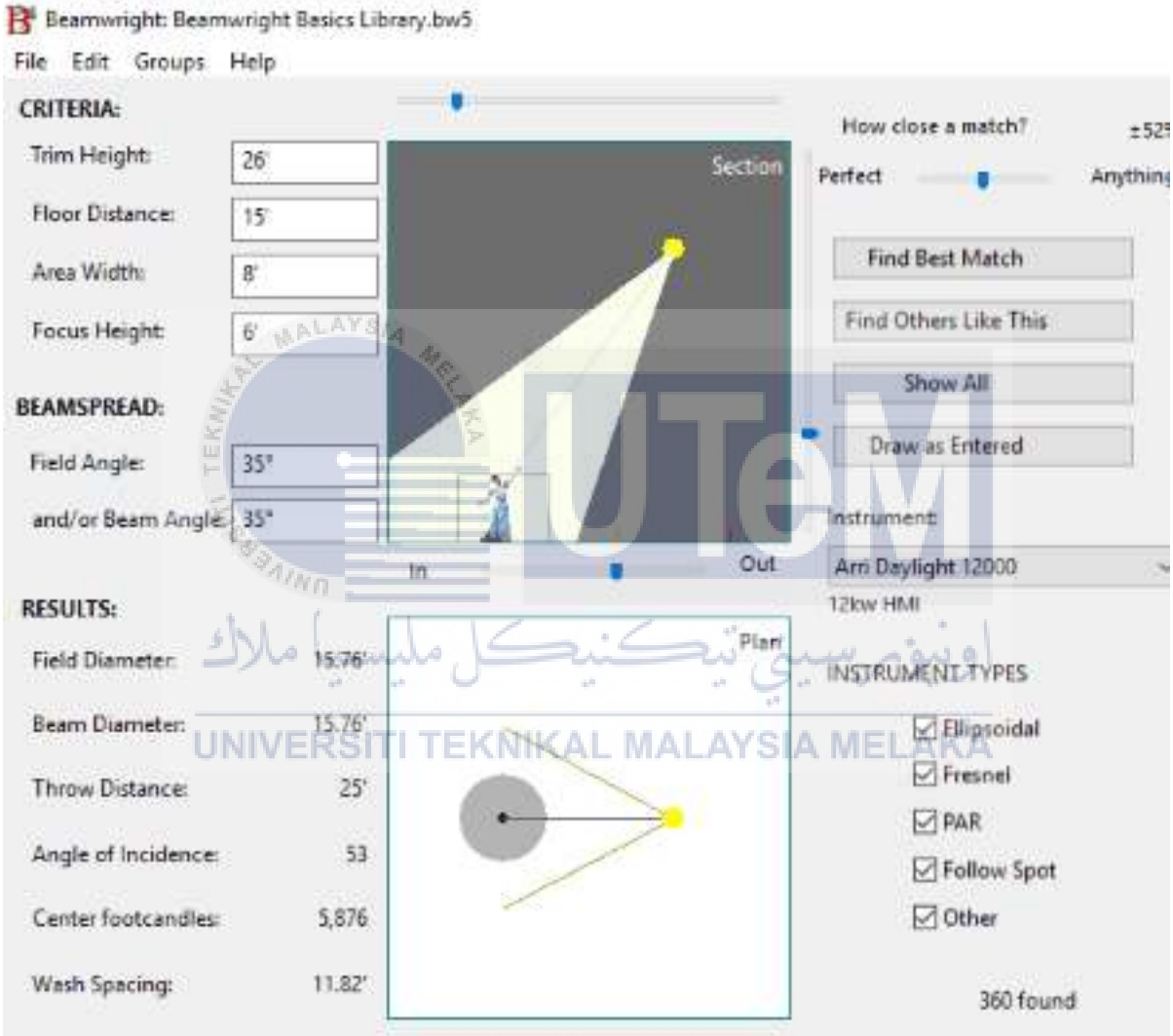
2.3.3.2 LIGHT DEMO

In this list, Light Demo is a basic lighting simulation programme. It allows you to replicate the effect of illumination on a variety of 3D items, including forms, ladies, dwarfs, lamps, chairs, soccer balls, books, and more. An object's substance can also be changed to brass, bronze, chrome, copper, polished copper, silver, pearl, and so on. It allows you to choose between directional, spot, or point lighting. You may also toggle between ambient light, point light, directional light, spotlight, and all light modes.



2.3.3.3 BEAMWRIGHT

Beamwright is a free lighting simulation programme that calculates how light behaves across a wide range of distances. Set up a position with a light dangling a few inches above the floor and a few feet distant from the person you wish to illuminate. Trim height, floor distance, area width, focus height, field angle, and beam angle are all options. You may also choose from a variety of light instruments, such as ellipsoidal, fresnel, PAR, follow spot, and so on.



2.4 LUX READING

2.4.1 Definition of LUX

In lighting design, lux is a unit used to quantify the intensity of light hitting a surface, usually a wall or floor. A lux is the same as a lumen per square metre. They are not to be confused with lumens, which are used to measure the brightness of a light source.

100 lux	This amount of light is enough for elevators, corridors, and stairwells. Areas that are only used by tenants for a short time and don't require any detailed upkeep.
150 lux	This amount of illumination is required in restrooms and plant rooms.
200 lux	This intensity of light is required for entrance areas and lobbies, as well as the minimum for a restaurant eating area.
300 lux	Assembly areas, such as village halls, must have a minimum of 300 lux.
500 lux	This should be the minimal light level in retail spaces and typical office settings.
More than 500 lux	This amount of light is enough for situations where precise and detailed work is required.