
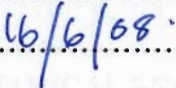


' I confess that have been read this outstanding piece of works and at my this piece of work is acceptable from the scope and the quality for the awarded Bachelor of Mechanical Engineering (Design and Innovation)

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DESIGN AND FABRICATION OF STREET LIGHT
USING MODERN PRODUCT DEVELOPMENT APPROACH

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THIS REPORT IS PRESENTED
AS COMPULSORY REQUIREMENT IN OBTAINING
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MAY 2008

“I confess this report is my effort on written except for summarization and quotation
which explained in the resources”

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Date : 13th MAY 2008

To my dearest parents, sister and brother

ACKNOWLEDGEMENT

Thank to Allah's love which had showed on me in giving good health, allowing me to generate creative idea to finish this PSM report.

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Not forgotten to all who has directly involved or indirectly in give co-operation to these project big thanks from me. Thank you.

Hope that this project can be useful knowledge or reference sources for other students.

Thank you so much.

ABSTRAK

Projek Sarjana Muda (PSM) merupakan kajian projek untuk semua pelajar tahun akhir Universiti Teknikal Malaysia Melaka (UTeM). Kod subjek ialah BMCU 4973 adalah matapelajaran wajib untuk mendapatkan Ijazah Sarjana Muda Kejuruteraan Mekanikal (Rekabentuk dan Inovasi). Tajuk projek ialah “Merekabentuk dan Menghasilkan Lampu Jalan Menggunakan Pendekatan Kemajuan Teknologi yang Terkini” Projek ini bermula dengan pencarian maklumat berkenaan dengan pengguna untuk mencapai kehendak mereka dan berakhir sehingga prototaip lampu jalan dapat dihasilkan, di mana mengaplikasikan fasa rekabentuk dan pembangunan product dalam konsep kerja secara serentak dalam kejuruteraan (Concurrent Engineering). Pelbagai program komputer di gunakan semasa menjalankan projek di antaranya ialah *Solid Works*, *Insight* dan *Magic* dan mesin penghasilan prototaip, *Fused Deposition Modeling* (FDM). Analisis adalah penting dalam untuk menganalisa setiap lukisan dan rekabentuk supaya dapat menghasilkan prototaip yang bagus dan stabil. Program komputer daripada *COSMOSWork* di gunakan. Nilai –nilai penguji untuk menguji ketahanan lukisan dan rekabentuk di perlukan agar keputusan analisa adalah tepat. Walaubagaimanapun canggih sesuatu teknologi , ia tidak terlepas dari kekurangan di mana permukaan prototaip berlaku kecacatan kecil dalam penghasilannya. Namun semuanya telah dapat di atasi dan dapat di hasilkan dengan masa yang singkat. Tujuan projek ini adalah untuk membuktikan masa sesuatu produk untuk di pasarkan lebih singkat menggunakan pendekatan kemajuan teknologi yang terkini selain menghasilkan produk yang bermutu tinggi.

ABSTRACT

Projek Sarjana Muda (PSM) is a research project for all final year students in UTeM. This subject code is BMCU 4973 and it is a compulsory requirements in obtaining the Bachelor of Science in Mechanical (Design and Innovation). The title of the project is “Design and Fabrication of STREET LIGHT Using Modern Product Development Approach”. In this project it covers Product design and Development phase starting with identifying customer’s needs until developing prototype based on Concurrent Engineering process. This report represent the methodology on design an fabricate street light using CAD software of Solid Works, Magic and Insight software, Fused Deposition Modeling (FDM) machine which are among the modern product development. Analysis process is important in making sure that each design is stable. COSMOSWork software is used to analyze the design. Some constraint needs to be considered during analysis to give the right and appropriate result. Although, high technology also can cause some defect which occurred during prototyping process on its surface and the problems have been solved. However it can be done in short period of time. Therefore, using modern product development approach can reduce time to market beside serve for high quality product.

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ABBREVIATION

3D	Three-dimension
CAD	Computer Aid Design
RP	Rapid prototyping
FDM	Fused Deposition Machine
MBMB	Majlis Bandaraya Melaka Bersejarah
UTeM	Universiti Teknikal Malaysia Melaka
SLA	Stereolithography
SLS	Selective Laser Sintering
TNB	Tenaga Nasional Berhad
JKR	Jabatan Kerja Raya
STL	Standard Triangular Language
ABS	Acrylonitrile butadiene styrene
CE	Concurrent engineering
R & D	Research and Development
NEMA	National Electrical Manufacturer's Association
DOF	Degree of Freedom

LIST OF APPENDIX

No.	Title
1	RP Technology
2	APPROVED STREET LIGHTING FURNITURE – UG SUPPLY
3	8 steps MBMB used for building up street light.
4	5 concept generation
5	Survey Result
6	Drawing

CHAPTER 1

INTRODUCTION

1.1 Project's Background

This is a project of an enhancement of street light using the modern product development approach through Concurrent Engineering process regarding to Product Design and Development concept.

“Concurrent Engineering is a systematic approach to the integrated, concurrent designs of products and their related processes, including manufacture and support,consider all elements of the product lifecycle from conception through disposal. Including quality, cost, schedule, and user requirement”, Department of Defense Institute of Defense Analysis (DoD/IDA), IDA report R-338 [1].

Technology approach that has been implemented during performs the design and fabrication of decorative light in this project is Fused Deposition Modeling (FDM) machine of Rapid Prototyping (RP) technology. Solid Works CAD data and Magic software also a bunch of RP technology content.

Street light is the lighting sources for user along roadway, park, city, and highway and so on. Moreover, street light is important equipment which can help us safety and for better journey and also show the development of each city with attractive design according to the viability of each area.

The research scope area is Malacca and gathered information about product design and development from MBMB and Muarlite Sdn. Bhd. which is one of supplier company that manufacture street light.

1.2 Aim

This project's aim is to develop product enhancement of street light using technology approach consist of Solid Work , CAE analysis and develop prototype using Fused Deposition Modeling (FDM) machine of rapid prototyping technologies and Concurrent Engineering Process.

1.3 Scope

This project covers on development and design of decorative light which is focusing on enhancement from the existing street light regarding to product design and development concept. Starts from identifying customer needs until develop prototype.

1.4 Problem Statement

Street light is the important necessary for consumer on road, highway, and residential area especially at night, dark day, dawn, rainy day. Beside that, street light can have innovation on its design which is not function as lighting source but can beauty the area called as decorative light. Using technology approach of RP, RT and concurrent engineering in performing product design and development concept, decorative light can reduce produce time and cost. It will help to decrease time product to market. Therefore, this project will prove that using technology approach to develop decorative light is reduce time and cost compare to conventional method approach that most company street light implement such as Muarlite Sdn. Bhd.

1.5 Report Outline

This project is consisting of 6 (six) chapters. Chapter (1) is the introduction of the project which contains the aim, objective, scope, problem's statement to make an enhancement on the design of existing street light using technology approach.

Chapter (2) is about literature review which reveal about street light and its component, Generic Product Development Process as design flow for street light development. Concurrent engineering process, rapid prototyping of FDM and rapid tooling of Vacuum Casting technologies are the technology approach that lies on this project which bring much advantages compare to the conventional approach.

Chapter (3) is explanation about methodology of experimental work process that been implement during project based on product design development concept. Starting from gather information, continue with determining conceptual design, sketches, CAD drawing using Solid Works, running COSMOSWork static analysis, and finally build prototype using FDM machine and finishing by polishing, painting and others.

Chapter (4) is the result that reflects on each methodology process in Chapter (3). There was more about the CAD data drawing, result of static analysis and prototyping process and problem occur during performing the methodology.

Chapter (5) is discussion on the finding. There were discussed about the source, purpose of force and pressure applied during analysis. Aluminum alloy 6063-T6 and ABS is selected material for decorative light after analysis is discussed on its mechanical properties. Joining process is determined in this chapter to joint and assemble each part. Cost estimation is done to complete design process. Finally, chapter (6) is the conclusion that concludes overall content of project report.

CHAPTER 2

LITERATURE REVIEW

In Chapter 2 (two) covers literature reviews which is an introducing about Products Design and Development Process and Concurrent Engineering process, Rapid prototyping and Rapid tooling technologies.

2.1 Street Light

Street light is a lighting source device that develops along road, highway, and residential area and etc. There was an important for consumer's safety especially at night or dawn. Streets light are consisting of concrete, pole, cable, luminaries, duct, conduit, junction boxes and controller. Luminaries are an important and many components for street light based on standard of Lighting Specifications and the National Electric Code [2] such as;

- Aluminum housing
- Protective case with a glass or plastic lens.
- Pressed glass refractor
- Aluminum removable hood-reflector assembly
- Lamp of high pressure sodium material
- Photocell as electrical component

2.2 Generic Product Development Process

“Product Development is the set of activities beginning with the perception of the market opportunity and ending in the product sales, and delivery of a product.” [3]. However, achieving successful in product development need high disciplinary on performing 5 (five) product development effort on determining product quality, product cost, development time, development cost and development capability in concept development phase as in Figure 2.1.

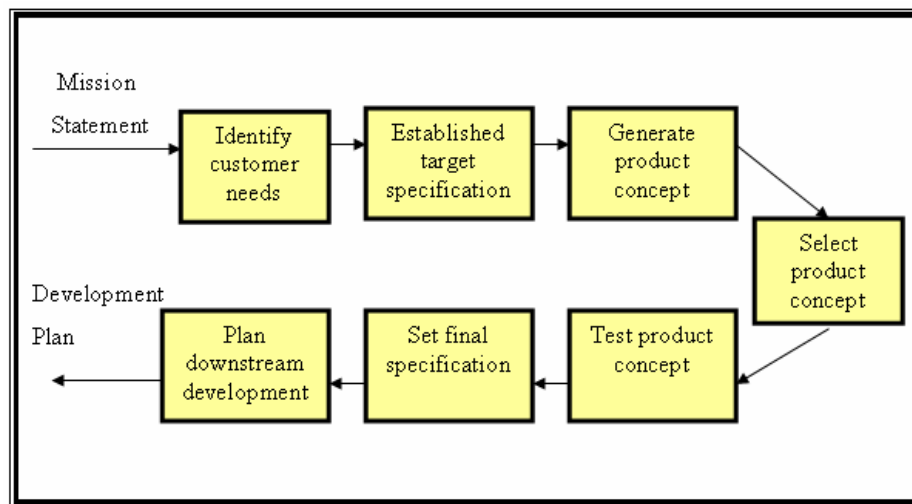


Figure 2.1 Concept development phases

(Source; Ulrich K.T and Eppinger S.D,2003)

2.2.1 Customer Needs

From figure 2.1, identifying customer needs is the philosophy behind the method is to create a high-quality information channel that runs directly between customers in the target market and the developers of the product [1]. There are five (5) steps method to identify customer needs;

Gather Raw Data from Customer

- Interviews
- Focus group
- Observing the product in use

Illustrate the Raw Data in Terms of Customer Needs

- Customer needs is illustrate into written statement based on raw data gathered.

Organize the Needs into the Hierarchy of Primary, Secondary, and Tertiary Needs.

- After gathered and illustrate the information, the result of both steps should be listed about fifty (50) until three hundred (300) need statement [4]. The producer for organizing the needs into the hierarchical is shown;
 - 1- Print or write each need statement on a separate card or self-stick note.
 - 2- Eliminate redundant statement
 - 3- Group the cards according to the similarity of the needs they express
 - 4- For each group, choose the label
 - 5- Consider creating super groups consisting of two to five group
 - 6- Review and edit the organized needs statements.

Establish the Relative Importance of the Needs

- A sense of the relative importance of the various needs is essential to making trades-offs correctly [5] and allocates resources in designing the product.
- Two basic approach to the task [5];
 - 1- Relying on the consensus of the team members based on their experience with customers
 - 2- Basing the important assessment on further customer surveysBased on these relative importance approaches, the team can make an educated assessment of the need in one meeting while customer survey takes less than two weeks.

Reflect on the Result on and the Process.

The team must challenge its result to verify that consistent with the knowledge and intuition the team has developed through many hours of interaction with customers [9].

2.2.1.1 Benefits of Customer Needs Identification.

Key benefits of identify customer needs are; [9]

- Product is focusing on customer needs
- Develop clear understanding among members of the development team of the needs of the customer in the target market.
- Developing a fact base to be used in generating concepts, selecting a product concept, establishing product specifications
- Creating an archival record of the needs phase of the development process

2.2.2 Product Specification

Specification is a step of the narrow scope to invent things or improve existing things based on customers need. Product specification to mean the precise description of what the product has to do [8]. There was not the innovation on address to customer needs but represent an unambiguous agreement on attempt to achieve in order to satisfy the customer needs [9].

2.2.2.1 Establish Target Specification

Target specification is established after the customer needs have been identified and established the specification. The target specifications must be refined after a product concept has been selected and before product concept has been generated.

Four (4) process of establishing the target specifications; [10]

- 1- Prepare the list of Metric
- 2- Collect competitive benchmarking information
- 3- Set ideal and marginally acceptable target values
- 4- Reflect on the result and the process.