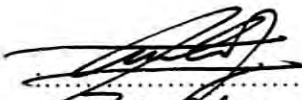


DEVELOPMENT OF ELECTRONIC MECHANICAL DESIGN SYSTEM
(E – MechSys) FOR CONSULTANCY SERVICES : PLUMBING AND SANITARY
APPROACH

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I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the Bachelor degree of Mechanical Engineering (Thermal-Fluids)

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This report is submitted to Faculty of Mechanical Engineering in partial fulfillment of the requirement for the award of the degree of Bachelor of Mechanical Engineering (Thermal-Fluids)

**Faculty of Mechanical Engineering
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November 2005

“ I hereby the author, declare that the work is my own except for quotations and summaries which have been duly acknowledged ”

Signature : 

Author : ARWA BINTI ARIS

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DEDICATION

Dedicated to my beloved family Papa (Mr Aris Bin Ujang), Mummy (Mrs Halimah Binti Saad), Sisters (Aishairma and Salwa)and Youngest Brother (Asrul Hikma and Agus Saffuan), my sweeties niece and nephew (Fatin Afrina, Faris Danial and Ahmad Irfan Danish) and also my friends which always be my side

ACKNOWLEDGEMENT

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To my beloved family and friends thanks for supported and actuated me to complete this project in successfully.

Thank you.

ABSTRACT

The purpose of this paper is to develop a computer program to assist in the design of plumbing and sanitary system in consultancy services. An attempt was made to lay the foundation for a reliable and efficient 'package type'. Program that will be able to handle the usual design challenges that are encountered in designing plumbing system in commercial and industrial application. A Visual Basic program are use to perform hydraulic calculation, water demand calculation, total pump capacity, pump horse power and discharge unit calculation for plumbing system with pipes already diameter and layout pattern already known. The interactive program determine the flow rate in all the pipes, loading, and head losses in the pipes. The algorithm uses an interactive method of calculation and employs the Hazen William equation for frictional loss computation in the pipe. These project will assists consultancy field especially in plumbing system either to get the result of calculation or information about the system. There is the wide scope in plumbing system, there is cold water plumbing system include hydraulic calculation, sanitary plumbing, water demand and pumping system. A visual basic will be used to create interface with related toolbar and coding to complete software development.

ABSTRAK

Sistem perisian dibangunkan untuk membantu merekabentuk sistem paip air dalaman dan sistem pembersihan dalam bidang jurutera perunding. Program ini mampu untuk bersaing dengan cabaran dalam merekabentuk sistem perpaipan dalam bidang kormesial serta penggunaan industri. Program Visual Basic akan melaksanakan pengiraan hidraulik, pengiraan bekalan air yang diperlukan dalam sesebuah bangunan, jumlah kapasiti pam air, pam berkuasa kuda dan pengiraan sistem pembersihan dalam sistem perpaipan di mana saiz diameter paip serta susun atur system perpaipan diketahui. Interaktif perisian ini akan dapat menentukan kadar alir yang berlaku di dalam paip, beban serta geseran yang terlibat di dalam paip yang di kaji. Persamaan Hazen William digunakan untuk menentukan geseran yang hilang dalam paip di mana prosedur kaedah ini lebih interaktif. Di Malaysia, persamaan ini digunakan untuk menentukan geseran dalam paip. Projek ini akan dapat memudahkan bidang perundingan terutama dalam sistem perpaipan, tidak kira dalam mendapatkan serta menentukan keputusan dalam pengiraan atau dari segi mendapatkan maklumat yang berkaitan semasa proses rekabentuk sistem perpaipan dijalankan. Skop yang terlibat dalam sistem perpaipan ini ialah sistem paip air dalaman termasuk pengiraan hidraulik, sistem pembersihan, penggunaan air serta sistem pam. Perisian Visual Basic digunakan untuk merekabentuk antaramuka dengan kekotak alatan yang terlibat serta kod program untuk melengkapkan pembangunan perisian.

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ABBREVIATION

| | | |
|-------|---|--|
| ACEM | - | Association of Consulting Engineer Malaysia |
| IEM | - | Institute of Engineer Malaysia |
| BEM | - | Board of Engineer Malaysia |
| M & E | - | Mechanical and Electrical |
| C & S | - | Civil and Structure |
| JKR | - | Jabatan Kerja Raya |
| HDPE | - | High Density Polyethylene |
| VB | - | Visual Basic |
| HVAC | - | Heating Ventilation Air Conditioning |
| ASPE | - | American Society of Plumbing Engineer's |
| IAOMP | - | International Association of Plumbing and Mechanical Office |
| SPIPE | - | Elite Software |
| Cmd | - | Command |
| lbl | - | Label |

LIST OF SYMBOL

| | | |
|--------|---|------------------------------|
| Q | - | Flow Rate |
| D | - | Diameter of Pipe |
| C | - | Coefficient of Pipe Material |
| H | - | Static Head |
| η | - | Efficiency of pump |
| igpm | - | Gallons per minute |
| ft | - | feet |

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Consulting Engineer is one of the agency/company that is to provide engineering services, which handle by professional engineers. Consultant has responsible to provide consultation to client in order to minimize project cost without neglecting authorities standard. This agency one of engineering field supervised by Association Of Consulting Engineer Malaysia (ACEM) under The Institution Of Engineer Malaysia, and registered as Professional Engineer with Board Of Engineers Malaysia. Hence, as consulting engineer they have to comply with the rules and regulations.

In Malaysia, consulting engineer is divided into two (2) major services group, which is Mechanical and Electrical (M&E), and Civil and Structure (C&S). The scope and services provided engineering as initial research, implementation and cost estimate, engineering design, project management and special services. Many systems in mechanical services such as air conditioning system, lift installation, plumbing system include cold water, hot water and sanitary plumbing, fire fighting system and others.

Cold Water and Sanitary Plumbing are part of mechanical services and shall in general be designed according to good plumbing design practice to conform to the rules and regulations of existing building by-laws and all relevant authorities having jurisdiction over the system. From the observation and research, most of the firm are using manual calculation method by referring to table and graph based on authorities guideline and formula as well especially in determining the friction loss in pipe. This method must be doing with full concentration in order to avoid any error to the result. By doing that we need more time just to ensure that the outcome is 100%correct.

Inline with mission to achieve developed country, we should create something that can be very useful to the consultant engineer firm and at indirectly can convince them to use a latest sophisticated technology. To make it a reality a software programming to calculate the required data for the system must be develop. This software will be use by mechanical consultant and helped them to calculate in the cold water plumbing system at the same time can reduce the design time and increase the accuracy. Visual Basic 6.0 application will be using to develop this programming.

1.2 Problem Statement

Plumbing system is a static system that divided to Cold Water Plumbing and Sanitary Plumbing. Hydraulic calculation and design system is a task need to be complete before project implementation. The problem in consultancy services in hydraulic calculation is needed more time, more concentration, and the result not accurate. This is because, there are many aspects needed to be considering in the calculation like pipe sizing, effective of pipe length (pipe run), flow rate in imperial gallon per minute (igpm), loss of head and others. Human error can occur, as example in implementing the formula application and as well as very difficult to produce calculation on time especially when time available is very limited (time constrain).

In order to increase their professionalism level, software was needed as an aid to engineers in order to minimize design time and increase the efficiency. It's involved mechanical services including the plumbing system. Its helps those to reduce manpower, human error and the energy wasted during the hydraulic calculation.

1.3 Objective

- a.) To develop software based mechanical design system using Microsoft Visual Basic.
- b.) To reduce the design time and increase the efficiency in mechanical consultancy services.

1.4 Scope

The scope of this project is about development of Electronic Mechanical design system (E-MechSys) for consultancy services in Plumbing system. This program will be building by using Visual Basic software, which is deriving from formula of hydraulic calculation.

1.5 Thesis Outline

Thesis outline is a summary of every chapter was described to introduce about the chapter. Chapter one (1) introduced about mechanical system in consultancy services and the objectives develop of the software. Then go to the chapter two (2) where all information about consultancy services in Malaysia and the plumbing system is discussed. It also includes about Microsoft Visual Basic and design consideration of plumbing system. The next chapter will describe the project implementation from collect data and information until the software was verified. After that, chapter four (4) will perform all steps to develop of software by using Visual Basic. The flow chart for each system will showing in this chapter which is there had more one form. Then go to chapter five (5), where the results from software development will performed. Its include summary of case study from the previous project in Mechanical Consultant. Recommendation and conclusion will explain in the end of this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Consultancy Services In Malaysia

Under the directive from the Government, more and more projects are to be engineered in Malaysia, with the Consultant setting up office either in premises assigned by the Client, or elsewhere in town of the Consultant's own choice.

The consulting engineer is a professional engineer in private practice. He maintains his own engineering office either alone or in association with other engineers. The services he provides may vary in scope from personal advisory services by one principal to major pre – investment studies involving other disciplines under his leadership or the complete planning and supervision of construction of large and complex projects involving the employment of many engineer and technician [7].

2.1.1 Function of Consultant Engineer

The scope and extend of the consulting engineering services required on any one project can be extremely varied. Some of the main services provided are listed below [7]:-

i.) Preliminary Investigations

Assessment of the client's needs and an analysis of the problem involved. Preliminary estimates of cost and recommendations.

ii.) Feasibility and Cost Benefit Studies

Examination of alternate engineering solutions for present and future needs and preliminary designs. Estimates for economic comparisons, including capital costs, operating costs and financing considerations

iii.) Engineering Design

Preparation of design calculation, detail plans, specification and contract documents for tendering and construction. The design includes calculations to determine size or capacity requirements, layout and detail arrangement of components, selection of equipment and materials, and where required testing of models and materials and specialized research.

iv.) Calling Tenders and Tender Appraisal

Obtaining tender prices from public or selected tendering, examination and evaluation of the tender and recommendations to the client

v.) Contract Supervision

Systematic inspection of works and equipment to ensure conformance with the plans and specifications. Examination and review of contractors shop drawing drawings. Testing and commissioning of equipment and processes. Continuous detailed supervision if required. This is additional to the normal inspection services provided by the Consulting Engineer.

vi.) Contract Administration

Having received the engineers report on tender, the client responsibility is to notify his agreement to the acceptance on particular tender. The engineers must then notify all tenders the client decision. Checking contractor's claims, issuing certificates for payment, coordination of other contracts

vii.) Project Management

If the client requires it a far more comprehensive Project Management service can be provided. This can include detailed project planning and control, procurement of equipment, awarding and coordinating separate contracts, expediting deliveries to the site, determination of cash flow, overall budget control and estimating.

viii.) Special Services

Site Investigation – foundation, geological, services, fuels and transport

Survey – topographic, hydrographic, aerial, detailed field, shop and laboratory inspection of material and equipment

2.1.2 Consultant Engineer Services

Consultant that involve in this field, comprise into a few type which are Architect, C&S Consultant, M&E Consultant, Quantity Surveyor Consultant and contractor. Architect is a company that designs the building and C&S consultant is a company that analyzes the civil parts and structure, M&E consultant is company that will provide the instrumentations of mechanical and electrical [7].