



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN AND DEVELOPMENT OF AN ALL TERRAIN MOBILE
ROBOT WHEELS**

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology
Bachelor Degree Manufacturing Technology in Product Design

by

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890223-14-5547

FACULTY OF ENGINEERING TECHNOLOGY

2015

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: DESIGN AND DEVELOPMENT OF AN ALL TERRAIN MOBILE ROBOT WHEELS

SESI PENGAJIAN: 2014/15 Semester 2

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Bachelor Degree Manufacturing Technology in Product Design)The member of the supervisory is as follow:

ENGR. HASSAN B. ATTAN
(Project Supervisor)

ABSTRACT

The purpose of this project is to design and develop of an all terrain mobile robot wheels. This project challenges assumption that, the paddle wheels design will intergrades into existing Mecanum wheels so it can run on both land and water surface area. This study will cover all about design of Mecanum wheels and paddle wheel that suitable for an all terrain mobile robot wheels. Firstly, the important element embedded inside this project is the methodology will be contract into the Design Process , which involve the reverse engineering of future paddle wheel and Mecanum wheel. Later, an experiment and simulation of working progress is done for the new concept of *paddle wheel*. Finally a 3D modeling assembly with Catia V5 is used to conduct a final view of all part of terrain mobile robot wheels. Results and discussion, from the simulation analysis is used to solve the equation an actual velocity and acceleration.

ABSTRAK

Projek ini adalah bertujuan untuk merekabentuk dan membangunkan sebuah roda yang mengerakkan robot kesemua kawasan. Projek ini mengandaikan cabaran itu dengan mereka bentuk semula roda bendayung dan digabungkan bersama roda Mecanum yang sedia ada, jadi ia boleh bergerak dikedua- dua kawasan darat dan permukaan air. Pelajaran ini akan meliputi tentang kajian reka bentuk roda Mecanum dan roda roda pendayung yang sesuai untuk semua roda yang menggerakkan robot ke semua kawasan. Pertama kali , ia akan membincangkan element penting yang tertanam didalam projek ini. Didalam kaedah metodologi dimana ia merangka perjalanan reka bentuk dan perlibatan pembuatan semula roda pengayuh dan roda Mecanum. Selepas itu , satu kemajuan kerja percubaan adalah untuk menguruskan suatu alat reka bentuk produk untuk konsep baru roda pendayung dan pemodelan rekabentuk '3D' dengan 'Catia V5' digunakan untuk menjalankan tujuan akhir semua sebahagian daripada rupa bentuk robot mudah alih. Untuk mengenai hasil dan perbincangan ,satu analisis simulasi aliran yang mudah dijalankan untuk penyelesaian persamaan halaju sebenar dan pecutan .

DEDICATION

Specially dedicated to my beloved father, En Yazid Bin Baba and my mother, Pn Fatimah Bt Idris who are very concern, understanding, patient, and supporting. Special thanks to my supervisor and second supervisor Engr Hassan Bin Attan and En Aminurrashid Bin Noordin, for the constructive guidance, encouragement and patient in fulfilling my aspiration in completing this project. To my sister, brother and my entire friend, the work and success will never be achieved without all of you.

ACKNOWLEDGEMENT

Allah the almighty. To Him I pray my wish and to Him I sang my worries. For all in the thing in this world, I only seek for His love, guidance and His forgiveness. Without Him I lost and nothing.

I would like to thank to my supervisor of this project, Engr. Hassan Bin Attan and En Muhammad Syafik bin Jumali for the valuable guidance and advice. They inspired me to work in this project. They willingness to motivate me contributed tremendously to my project. I also would like to thanks them for showing me some example that related to the topic of my project.

Besides, I would like to thank to FTK Technical support staff manufacturing technology for helping me to develop the prototype. Thanks Fakulti Kejuruteraan Pembuatan for providing me with a good enviroment and facilities to complete this project.

Finally, an honourable mention goes to my families and friends for their understandings and supports on us in completing this project. I offer my regards and blessings to all of those who supported me in any respect during the completion of the project. Without helps of the particular that mentioned above, I would face difficulties while doing this project.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

Al	-	Aluminium
ANOVA	-	Analysis of Variance
ASEAN	-	Association of Southeast Asian Nations
AT	-	Annual Turnover
Cl	-	Chlorine
F	-	F Test (ANOVA)
FMM	-	Federation of Malaysian Manufacturers
HU	-	Highly Used
IT	-	Information Technology
LU	-	Least Used
M	-	Million
MITC	-	Melaka International Trade Centre
MNC	-	Multinational Company
MU	-	Moderately Used
NOYP	-	Number of Years in Operations
NOE	-	Number of Employees
NU	-	Not Used
PP	-	Polypropylene
PCL/TPS	-	Polycaprolactone/Thermoplastic Starch Blend
RM	-	Malaysian Ringgit
SD	-	Standard Deviations
SME	-	Small Medium Enterprise
U	-	U Test (Mann Whitney Test)
>	-	More than
σ	-	Stress
ϵ	-	Strain
τ	-	Torque

CHAPTER 1

This chapter discusses the basic idea of this PSM1 project; design and development of an all terrain mobile robot wheels. The topic that will be covered in this chapter is project background, problem statement, project aim & objective, scope, project planning and expected outcome.

1.1 Background

In general, robots are designed and controlled by a computer or similar device. The motion and movement of the robot are controlled through a controller that is under the supervision of the computer, in other words, itself is running some type of program. If the program is change, the action and motion of robot will also automatically change. Therefore, the robot is designed to able to perform any task that can be programmed within limit, of course simply by changing the program. There are various ways to defining a robot. Robot is a device that effective for us to do work for us or move anything that we want, via its functions. Wheel is used to help the robot navigation to do movement from a place to another place. Mecanum wheel was designed and invented in Sweden in 1973 by Bengt Ilon, an engineer with Swedish company Mecanum AB (Diegel et al 2002). Mecanum wheel is based on the principle of a central wheel. With a number of rollers placed at an angle around the wheel. The angled peripheral roller translates a portion of the force in the rotational direction of the wheel to force normal to the wheel directional. Depending on each individual wheel direction and speed, the resulting thus allowing the

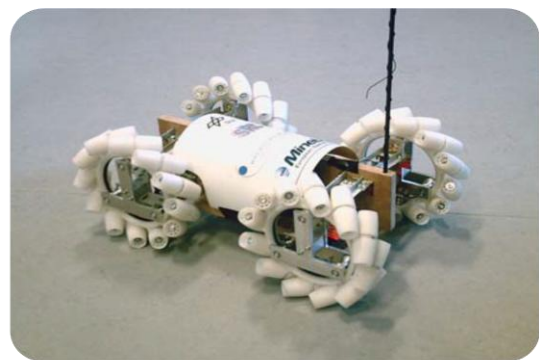
platform to move freely in direction of resulting force vector, without changing the direction of the wheel.

1.2 Introduction of all terrain mobile robot.

An terrain mobile robot is an automatic machine that is capable of robot category because robot can perform desired tasks in any kind of environments without continuous human guild. There are many categories of mobile robot such as manual remote, line-following robot, autonomously guild robot and sliding autonomy. For mobile robot wheels, the Omni directional wheels have been used in robotics, in industry, and in logistics for many years. By reviewing and analyzing systematically the existing literature concerning this type of wheels, it was revealed that systems based on Mecanum wheels detain Omni directional capabilities, whereas systems based on conventional wheels do not. Specifically, these capabilities make the vehicle extremely maneuverable, which could be very helpful in different indoor and outdoor applications. Therefore, compared to conventional vehicles, Omni directional robotic vehicles possess multiple advantages in terms of their mobility in narrow spaces and crowded environments. They have the ability to easily perform certain tasks in congested environments foreseen with static obstacles, dynamic obstacles or narrow areas. Usually, such environments are found in grounds and water surface area, instead the water surface area was limited to complete.



MIROC 2013 & 2014



(Vogler, Vittori, Ransom, & Granziera, 2007)

1.3 Problem statement.

The idea of this project is to design and develop of an all terrain mobile robot wheel by using Mecanum wheels with the problem statement as follows ;

- a) An all terrain robot wheels cannot run on water surface area.
- b) How to design and intergrades the paddle wheel on existing Mecanum wheel without interference the movement and application of the Mecanum wheels.

1.4 Objective of the project.

The aim of this project is to design and develop of all terrain mobile robot wheels. To achieve this aim, the followings need to be fulfilled :

- a) To design an all terrain mobile robot wheels that can function on both land and water surface area.
- b) To design a suitable paddle wheel.
- c) To integrate the design of paddle wheel into Mecanum wheels.
- d) To apply product design tool and CAD 3D modeling in the design and analysis.

1.5 Work Scope.

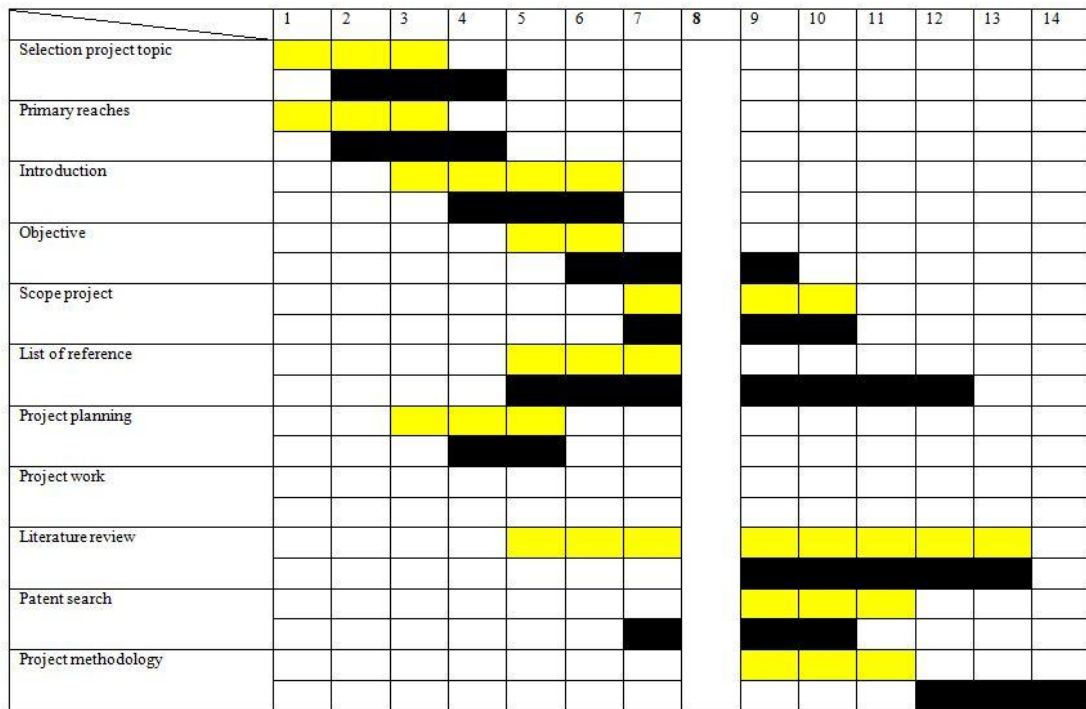
The Scope of project is very important in order to support in the build and development process of this project. Listed below are the descriptions of scope for this project:

- a) Study the design of Mecanum wheels and paddle wheel that suitable for an all terrain mobile robot wheels.
- b) To apply product design tool to determined the best design.
- c) To produce a 3D modeling and detail design of an all terrain mobile robot wheels using a variable cad software.
- d) Conduct a simple design analysis to validate the design of the product.
- e) To produce the prototyping to validate and test the product.

1.6 Result expectation.

- a) The design will be apply a product design tool to determined the best design so the 3d modeling and detail design can use on variable cad software.
- b) Design analysis to validate the design of the all an terrain mobile robot wheels.
- c) Develop the prototyping then validate and test on an all terrain mobile robot wheels.

1.7 Gant chart PSM1.



1.8 Gant chart PSM2.

