DESIGN AND MODELING OF ZERO-ENERGY WHEELED MOBILE ROBOT (WMR)

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A thesis submitted in partial fulfillment of the requirements for the award of Bachelor Engineering (Hons) Mechanical

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MAY 2010

"I hereby, declared that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not currently submitted in candidature of any degree"

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Date : 19/5/2010

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ACKNOWLEDGEMENT

This final year project was completed with the contribution of many people whom I would like to express my sincere gratitude. They have contributed towards my understanding, experience, and thought.

Firstly, I would like to convey my sincere thanks and gratitude to my supervisor, Mr. Mohd Asri bin Mohd Nor, lecturer in Faculty of Mechanical Engineering for his patience, time, guidance, comments and friendship throughout this final year project duration until its completion. His advices really kept me going and help me to look into this project in perspectives.

I am also indebted to my project's team member, Nurain Abdul Lazit, Master's student, Mr. Saiful for their help, guidance, and assistance given for the relevant information towards making this project complete.

Finally, I am deeply grateful to my family for their unconditional love, continuous support, encouragement and care through out my studies. This project would not have been like this if they had not given great support as this project really needs my commitment to the fullest.

ABSTRACT

The aim of this project is to design, model, and analyze a zero-energy wheeled mobile robot (WMR). This project begins with designing a small mobile robot that uses four wheels to move on an uneven terrain. This project consists of two sections; fabrication and the development of an autonomous control. This project focuses on fabrication aspect of WMR. The WMR uses wheels as a means of its locomotion. The design philosophy for WMR movement will be based on the angular velocity difference between right and left wheels. To achieve such control, four motors that drives each wheel is interfaced with PIC circuit that received signal from a sensor. This project also deals with kinematic and dynamic analysis of a WMR consists of four wheels and used skid-steering locomotion system to move. To control a WMR is a challenging task because the wheels must skid laterally to follow a curved path. For the kinematic analysis, a mathematical model is derived to get the relationship between all the four wheels. Omega theorem is used in the analysis. This theorem is used to determine and analyze the velocity for each wheel when it rotates with an absolute angular velocity but with constant magnitude. As a result, wheel on both side (left and right) must rotate at the same velocity to make sure this WMR follow the exact path and move on smooth condition when avoid obstacle, and also to avoid high friction between the wheels and ground that will make this WMR use more energy to move. For dynamic analysis, Transfer theorem equation has been used to get kinetic energy and angular momentum for this WMR.

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