SUCTION CONTROLLER FOR WINDOW WIPING ROBOT

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"I hereby acknowledge that the scope and quality of this thesis is qualified for the award of the Bachelor of Electrical Engineering (Control and Instrumentation)"

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To my beloved father, Noor Azmi b. Mohamed and mother, Hamidah bt. Abu Bakar,
Who always pray for me and give me courage to finish this thesis.

And also to those people who have guided and inspired me throughout my journey.
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ABSTRACT

The objective of this project is to develop suction controller for small-size and light weight window wiping robot. The prototype of window washing robot already been developed. The dimensions of prototype robot are approximately 150mm x 100mm x 50mm and its weight is approximately 0.5kg. For the suction controller of this robot, 3 vacuum pump and 3 active suction cups are use. To control the suction of this robot, PIC are use to program so that the suctions will be the same at all three dc motors. The speed of dc motors also can be control by using potentiometer to save the power consumption according to the angle of the window. The movements of the robot are also changed by using wheels to make it compatible with the suction controller. With the suction controller, the robot can move on the surface of the window without falling down.

ABSTRAK

Tujuan projek ini ialah untuk membangunkan system kawalan sedutan untuk robot pencuci tingkap. Prototaip robot ini telah dibangunkan sebelum ini. Anggaran dimensi robot ini ialah 150mm x 100mm x 50mm dan beratnya ialah 0.5kg. Untuk kawalan sedutan ini, 3 biji dc motor dan 3 mangkuk sedutan aktif telah digunakan. Untuk mengawal kawalan sedutan ini, PIC digunakan dengan memprogramkannya dengan aturan kawalan untuk ketiga-tiga dc motor tersebut. Kelajuan ketiga-tiga dc motor ini juga boleh dilaraskan menggunakan penyelaras rintangan mengikut kesesuaian kedudukan sudut tingkap untuk mengurangkan tenaga yg digunakan. Pergerakan robot ini juga telah diubah dari asal untuk menyesuaikan dengan kawalan sedutan ini. Dengan menggunakan kawalan sedutan ini, robot pencuci tingkap ini dapat pergerak di atas permukaan tingkap tanpa jatuh.

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INTRODUCTION

1.1   Background

Nowadays, the needs of supporting equipments in our daily lives are very important for the people who do not have enough time to organize their house or office. The realization of how important the support equipments in our lives are expanding through everyone this day. Support equipments need system in order to make the equipments functions according to what we want. Electronics, mechatronics and informatics are key technologies to achieve the support system. Especially, a robot, which is made by their integration, is expected as the main equipment. To realize the practical robot at home, a small office and a shop, the robots are require to meet four conditions at the minimum: compact, lightweight, safety and inexpensive.

In many practical, autonomy of a mobile robot means that the robot not only acts autonomously, i.e. it navigates and fulfils its task without any human intervention. But the robot should also carry its own power supply in order to operate without an umbilical cable. While this energy-autarky is not a severe problem for wheeled mobile robots, it is a real challenge for climbing robots because the weight of a climbing robot is of tremendous importance, and hence also the weight of the weight of the power supply. For energy-autarkic climbing robot it is thus essential to keep the weight and the energy consumption as low as possible.

Note that a great amount of high rise buildings are emerging in modern cities today. Every architect prefers to present the new buildings to the world with his own characteristics. That is why the number of high-rise buildings with complicated shapes is

increasing worldwide. However these external cladding walls require constant cleaning. As a result, even skilled workers with safety ropes have 2 difficulties in climbing those buildings and currently almost of them are still cleaned manually. The development of walking and climbing robots offers a novel solution to the above-mentioned problems. Because of the current lack of uniform building structures, window cleaning and maintenance of high-rise buildings is becoming one of the most appropriate fields for robotization. A cleaning robotic system can make the automatic cleaning of high-rise buildings possible and relieve cleaning workers of their hazardous work.

Window wiping is one of the important works among various kinds of cleaning. Fine windows provide comfortableness to people and keeping the window clean is important for the shops and offices. Therefore, to develop a robot for window wiping robot are the smartest things to do now. But, the suction controller for window wiping robot is the most important part for this robot. The suction controller will be the key for this robot to function efficiently or not. This research aims at developing the suction controller for window wiping robot that works inside of frames of wide window.

In this project will construct and program a suction controller. The heart and mind of this controller is PIC18F4550 microcontroller. The microcontroller will be programmed by using the PBASIC Pro compiler. Three dc motor were use to generate vacuum around the surface of window. This three dc motor were connected parallel to each other in order to generate enough vacuum suction to support weight of the robot. These dc motors were chosen because of the size that fulfills the criteria we need to design this controller that need low cost and lightweight.

A suction controller of this window wiping robot consists of two elements, which are holding equipment and moving equipment. The holding equipment is the important mechanism to attach the robot on the surface of window. The moving equipment moves the robot along the surfaces of window. This project mainly develops the holding equipments and the moving equipments because they are core components and because they run cooperatively. The robot will climb forward while monitoring the value that

receives from the limit switch sensor module. If an obstacle is detected the robot will stop and crawl backward. The robot will repeat this step each time the limit switch is sense the obstacle.

This project is divided into two main sections: the electronic designs and the mechanical designs. Then this two design combined together to perform a window wiper robot. Please refer to the flowchart below. (Figure 1.1)
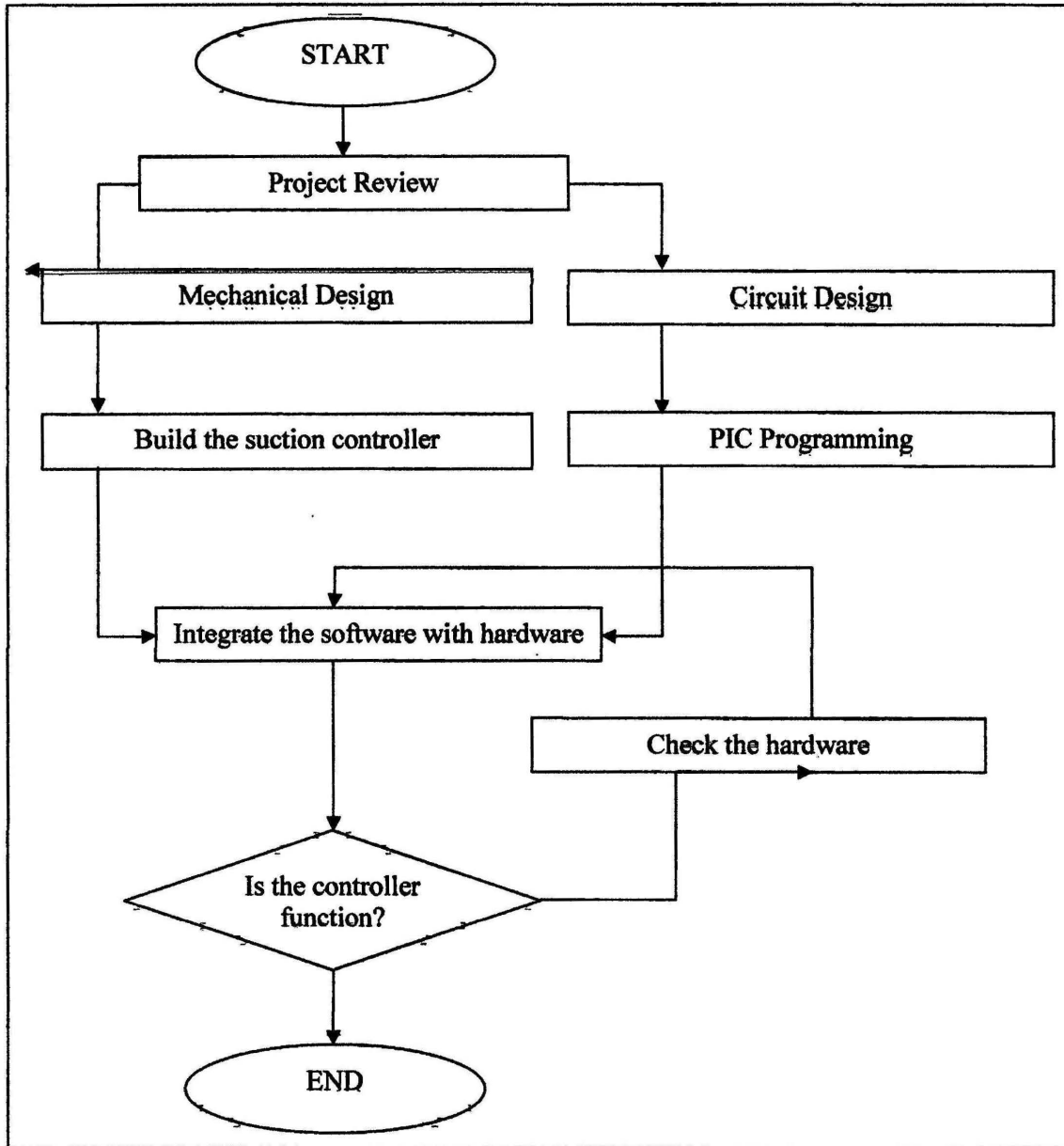

Figure 1.1: Flowchart of the project flow

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