UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AUTOMATED ROBOT FOR AREA MAPPING

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

by

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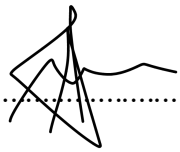

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ABSTRAK

Peningkatan keperluan manusia telah mendorong perkembangan sektor robotik. Proses mengukur kawasan dalam pembinaan bangunan dilakukan secara manual oleh orang. Alat untuk mengukur lebar dan tinggi panjang adalah pita pengukur dan ukuran pita laser. Pita pengukur secara meluas dan biasa digunakan untuk pengukuran, masalah yang biasanya terjadi adalah mengukur kawasan yang tidak lurus. Batasan lain menggunakan pita pengukur di mana ia hanya berukuran hingga 100 kaki sahaja. Untuk pengukuran yang panjang, ini akan mempengaruhi ketepatan pengukuran. Selain itu, kelemahan bagi ukuran pita laser ialah apabila mengukur jarak pendek, beberapa model tidak begitu berkesan. Harga berbeza mengikut kemampuan setiap peranti. Oleh itu, ukuran pita laser yang terbaik dan berkualiti datang dengan harga yang lebih tinggi dan harganya lima kali lebih tinggi daripada yang biasa. Tujuan utama pengembangan robot automatik untuk pemetaan kawasan adalah untuk alat bantu untuk mengukur luas bilik. Projek ini juga memberi bacaan ukuran. Untuk mendapatkan sistem berfungsi secara autonomi, mikrokontroler Arduino Mega digunakan sebagai otak mesin bersama dengan sokongan sensor ultrasonik dan modul sensor pengekod sebagai alat pengukuran perpindahan. Pengawal mega Arduino juga dilengkapi dengan ciri sistem perisian bekalan terbuka yang membolehkan pembangun sistem perisian yang sukar menggunakan kod Arduino untuk bergabung dengan perpustakaan bahasa pengaturcaraan yang berlaku dan boleh diperluas dan diubah. Sensor ultrasonik berfungsi untuk mengelakkan halangan ditambah sebagai pergerakan membantu.

ABSTRACT

The increase in human needs has led to further development of the robotics sector. The process to measure the area in building construction are done manually by persons. Tools for measuring length width and height are measuring tape and laser tape measure. Measuring tape is widely and commonly used for measurement, the problem that usually occur is measuring an area that is not straight line. Another limitation using measuring tape where it only up to 100 feet measurement only. For a long measurement, this will affect the accuracy of the measurement. Other than that, is the drawback for the laser tape measure is that when measuring short distances, some models are not as effective. Prices differ as per each device's capabilities. Therefore, the best and more quality laser tape measure comes with higher price and it can cost five times higher than common one. The main purpose of the development of automatic robot for area mapping project is for assistive device for the measuring the room area. This project also gives the measurement readings. To get the system works autonomously, Arduino Mega microcontroller is used as the brain of the machine along with the supports of ultrasonic sensor and encoder sensor module as the displacement measurement device. The Arduino mega controller also comes with open supply software system feature that permits tough software system developers to use the Arduino code to merge with the prevailing programing language libraries and may be extended and changed. The ultrasonic sensors function to avoid the obstacle plus as movement assistive.

DEDICATION

I would like to express my special dedication to people who support me with this thesis. I am grateful and acknowledge for both of my parent also sibling for gives me encouragement and endless support to me for complete this Bachelor Degree Project (BDP). Without them, I probably not reach this stage. Besides, special thanks for all of my fellow lecturer for advice, taught and guidance through my studies. Not forgetting, all of my beloved friend throughout this wonderful journey. Last but not least, thank you to all people who help me directly or indirectly for the support in completing this project.

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LIST OF SYMBOLS

D, d	-	Diameter
1	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
r	-	Radius
T	-	Torque
V	-	Velocity
x	-	Displacement
z	-	Height

LIST OF ABBREVIATIONS

SLAM	Simultaneous localization and mapping
MBES	Multibeam echo sounders
SBES	Single beam echo sounders
LiDAR	Light detecting and ranging
AUV	Autonomous underwater vehicle
MIT	Massachusetts Institute of Technology
GPS	Global positioning system
UKF	Unscented Kalman Filter
LGPL	Lesser general public licence
GPL	General public license
DIY	Do-it-yourself
IDE	Integrated development environment
TFT	Thin-film-transistor
LCD	Liquid crystal display

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will discuss about the background of the project, problem statement, objectives, scope of the project, significance study and the thesis outline.

1.2 Background

Measurement instruments and units for construction works are generally classified by their design, shape, and size. Measurement is the transformation of drawn information into definitions and quantities, undertaken to work on meaning, expense and pricing as well as to encourage effective management. The unit of measurement concept usually consists of single units works like doors, windows, trusses and others that expressed in numbers. Works consist of linear measurement in running metres, such as cornice, fencing, handrail, defined bands of width. In addition, work involves calculation of the area surface area such as plastering, partitions of different thickness in square metres. Other works include cubic contents, such as earthworks, concrete usually expressed in cubic meters.

The construction works can be evaluated varies depending on its use and the level of the project. The estimates usually based on general parameters like functional unit for example cost per hospital bed, cost per theatre seat and so on. Other than that, is

floor area, gross floor area as per cost of per square feet metre. A detailed floor plan design is a must whether for designing a home remodelling building up a commercial space or just need measurements to organize furniture positioning. First, the determination for level of accuracy is required. The size of the structure must be measure approximately to show a general internal arrangement. Measuring exterior walls within closest ¼ or even ½ foot is usually enough.

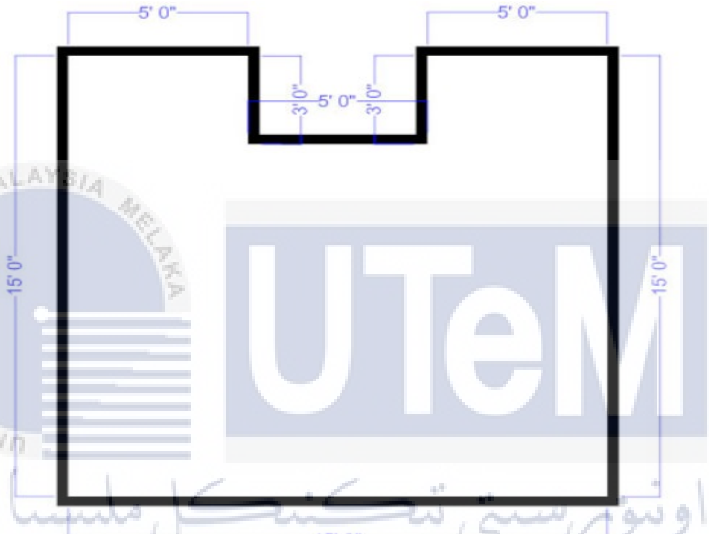

Figure 1. 1: Example measurement of a layout

The next procedure is start by measuring the perimeter. Rough outline of the dimensions of the room or outside of the building if exterior measurements needed must be done to have good visual starting point. Measure the longest wall first and to do that is running the tape measure along the baseboard from one corner to other. Drag the tape over the baseboard to get a complete wall-to-wall dimension.de