DESIGN A LINE FOLLOWING MOBILE ROBOT
WITH DISTANCE MEASUREMENT

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May 2008

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation & Automation)"

Signature : ……

Supervisor's Name : ……..

Date : ……..

"I hereby declared that this report is a result of my own work except for the works that have been cited clearly in the references."

Signature : ……..
Student : AMIRUL NUR RASHID BIN MOHAMAD AHYAT
Date : 5 May 2008

Dedication to my beloved parent.

Thank you so much for helping.

ACKNOWLEDGEMENT

ASSALAMUALAIKUM. . . . .

Firstly I have to thank Allah S.W.T. because the goodness that gives me strength in order to complete my PSM project. I have successfully finished my PSM project even though I have to gone through many difficulties during the process to complete the project. Very special thanks to my parent because of their support in term of financial and advice. Also very special thanks go to my project supervisor, Mr Ahmad Aizan Bin Zulkefle who is so supportive and has contributed a lot of ideas, and advice to me for realizes this project. He also was committed in helping pain to train me to be a versatile designer or engineer. His words of encouragement have kept me going and his kindness has made this project a valuable experience.

Last but not least, thanks to all my friend for giving me so much supports to obtain the output of this project and spending their time teaching me about the PIC microcontroller connection, which seems to be very difficult for me to understand before.

All the knowledge gained at Universiti Teknikal Malaysia Melaka (UTeM) present here in my PSM project report. I would like to beg my forgiveness for any problems, which occurred during realization this project.

Thank You.

ABSTRACT

The main purpose of doing this project is to apply micro technologies to the other operational technologies which it can work independently. Mobile robots are autonomous machines that are capable of movement in a given environment in which they can perform desired tasks in unstructured environments without continuous human guidance. Different robots can be autonomous in different ways. Mobile robots are also found in industry, military and security environments, and appear as consumer products. A line following robot is one of the mobile robot where the robot is moving base on the line tracking. The main parts of this mobile robot are sensor, motor and controller. This mobile robot is being program to follow the black line on the white base or floor. The sensor will detect the line on the floor and send signals to controller to be processed. After that, it sends signals to motor to rotate and the robot is moving base on the signal given. To program the mobile robot, Programmable Integrated Circuit (PIC) microcontroller is used to detect black line and moving on the track. The mobile robot is also capable of measuring the distance travelled which is displayed on the Liquid Crystal Display (LCD) in a real-time.

ABSTRAK

Tujuan utama perlaksanaan projek ini adalah untuk mengaplikasikan teknologi di dalam pengoperasian sesuatu teknologi yang boleh bergerak sendiri. Robot mobil merupakan sebuah mesin yang mampu bergerak mengikut arahan yang diberi tanpa memerlukan pengawasan manusia. Robot-robot ini mempunyai tugas yang berlainan bergantung pada arahan yang telah diaturkan. Robot-robot ini boleh dijumpai di industri, kawasan-kawasan sekuriti serat bertindak sebagai penghantar produk. Robot mengikut garisan merupakan suatu robot yang bergerak mengikut garisan yang telah diaturkankan programnya. Robot ini akan bergerak sama ada pada garisan hitam dengan permukaan putih atau pada garisan putih dengan permukaan hitam bergantung pada arahan yang telah diprogramkan. Bahagian-bahagian utama robot mengikut garisan ini adalah seperti motor, mikro-pangawal dan pengesan. Pengesan ini akan mengesan garisan di permukaan lantai dan seterusnya menghantar isyarat pada mikro-pengawal untuk diproses. Selepas itu isyarat tadi akan menggerakkan motor dan robot akan bergerak mengikut isyarat yang diberi. Untuk memprogram robot ini, mikro-pengawal PIC digunakan untuk mengasan garisan. Robot ini juga mampu mengukur jarak pada masa yang sama ketika robot ini bergerak mengikut garisan tersebut. Jarak ukuran tersebut akan dipaparkan pada Paparan Kristal.

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LIST OF ABBREVIATION

PIC	-	Programmable Integrated Circuit
LCD	-	Liquid Crystal Display
RAM	-	Random Access Memory
LED	-	Light Emitting Diode
IR	-	Infra-red
PLC	-	Programmable Logic Controller
PMMA	-	Polymethyl Methacrylate

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

1.1 Introduction

The word robot originated from the Czech word ‘robota’, which means 'slave labour'. The term robotics was coined by Isaac Asimov in his short science fiction in 1940s, in which he defined robotics as a study of robots. A robot is a re-programmable multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for performance of a variety of tasks (Snyder, 1985).

The word robot is used to refer to a wide range of machines, the common feature of which is that they are all capable of movement and can be used to perform physical tasks. Robots take on many different forms, ranging from humanoid, which mimic the human form and way of moving, to industrial, whose appearance is dictated by the function they are to perform. Robots can be grouped generally as mobile robots (autonomous robots), manipulator robots (industrial robots) and self reconfigurable robots, which can conform themselves to the task at hand. Robots may be controlled directly by a human, such as remotely-controlled bomb-disposal robots, robotic arms, or shuttles, or may act according to their own decision making ability, provided by artificial intelligence. However, the majority of robots fall in-between these extremes, being controlled by pre-programmed computers. Such robots may include feedback loops such that they can interact with their environment, but do not display actual intelligence.

Mobile robots are autonomous machines that are capable of movement in a given environment in which can perform desired tasks in unstructured environments without continuous human guidance. Many kinds of robots are autonomous to some degree. Different robots can be autonomous in different ways. The most common class of mobile robots is wheeled robots. A second class of mobile robots includes legged robots while a third smaller class includes aerial robots, usually referred to as unmanned aerial vehicles. Mobile robots are also found in industry, military and security environments, and appear as consumer products. A path finding robot is one of the mobile robot where the robot is moving base on the line tracking. The main parts of the robots are sensor, motor and controller. The line can be in white / black line tape on the floor. The sensor will detect the line on the floor and send signals to controller to be process. After that it send signals to motor to rotate and the robot is moving base on the signal given.

1.2 Problem Statement

In factories, the workers usually moved objects or material manually. It will waste a lot of man power and also will waste money to employ them to do the task. This mobile robot can avoid this problem and make easier. Line grids can be placed on the floor to indicate the path that the robot requires to go.

1.3 Objectives

The main objective of this project is to assist and expose beginners who wish to learn about robotic system such as micro-controller (PIC16F877A), programming, electrical parts, electronic circuits and also to enhance knowledge and build the creativity in robotic field. Besides that, this project also design a line following mobile robot and display the distance measurement in real-time on the Liquid Crystal Display (LCD).

1.4 Scope of Project

The scope of the project is to design and develop a path finding robot using a line tracking. It consists of designing the electronics part and develops a program. The function of the robot is to find a path base on a line tracking and display the measurement on the LCD on the real time. The robot will move base on the white line on the dark floor sense by an infra-red sensor.

1.5 Project Schedule (Gantt Chart)

Project schedule is very important to manage the project. It can make us to finish the project on the fix time. So, it is very important to avoid us from delay the project. (Refer Appendix A)

1.6 Summary

This chapter explained about the introduction of the project and the backgrounds of the robot. Besides that, here are also explained about the problem statement, objectives and scope of project. Base of this factor, this project was selected to minor the problem.

CHAPTER 2

LITERATURE REVIEW

2.1 First Review: Robotic Follow System and Method.

Robot platforms, methods, and computer media are disclosed. The robot platform includes preceptors, locomotors, and a system controller, which executes instructions for a robot to follow a target in its environment. The method includes receiving a target bearing and sensing whether the robot is blocked front. If the robot is blocked in front, then the robot's motion is adjusted to avoid the nearest obstacle in front. If the robot is not blocked in front, then the method senses whether the robot is blocked toward the target bearing and if so, sets the rotational direction opposite from the target bearing, and adjusts the rotational velocity and translational velocity. If the robot is not blocked toward the target bearing, then the rotational velocity is adjusted proportional to an angle of the target bearing and the translational velocity is adjusted proportional to a distance to the nearest obstacle in front.

2.2 Second Review: Mobile Robot.

A mobile robot which has a communication with a detection target by a motion of the mobile robot or by an utterance from the mobile robot, the mobile robot includes: a personal identification unit detecting an existence of the tag based on a signal transferred from the tag and obtaining the identification information stored on the tag; a position information acquisition unit obtaining

distance information indicating a distance from the mobile robot to the detection target; a locomotion speed detection unit detecting a locomotion speed of the mobile robot; a personal information acquisition unit acquiring personal information based on the identification information; a communication motion determination unit determining contents of a communication motion based on the personal information; and an operation determination unit adjusting a start timing of each content of the communication motion based on distance information and on the locomotion speed of the mobile robot.

2.3 Third Review: Obstacle Following Sensor Scheme for a Mobile Robot.

A robot obstacle detection system including a robot housing which navigates with respect to a surface and a sensor subsystem aimed at the surface for detecting the surface. The sensor subsystem includes an emitter which emits a signal having a field of emission and a photon detector having a field of view which intersects the field of emission at a region. The subsystem detects the presence of an object proximate the mobile robot and determines a value of a signal corresponding to the object. It compares the value to a predetermined value, moves the mobile robot in response to the comparison, and updates the predetermined value upon the occurrence of an event.

2.4 Fourth Review: Robot System and Autonomous Mobile Robot.

The present invention relates to a robot system which includes an autonomous mobile robot as well as to the autonomous mobile robot. In the system in which monitoring is performed using the autonomous mobile robot which travels along a predetermined path, the present invention can reduce the interval between the time when a user requests transmission of images or the like and the time when the user obtains the images. The autonomous mobile robot travels along a predetermined path at predetermined times, a camera takes

photographs at predetermined locations during the travel along the predetermined path, images taken by the camera are stored, and the stored images are sent to a requesting cell phone or the like in response to a transmission request from the cell phone or the like. (Refer Figure 2.1)

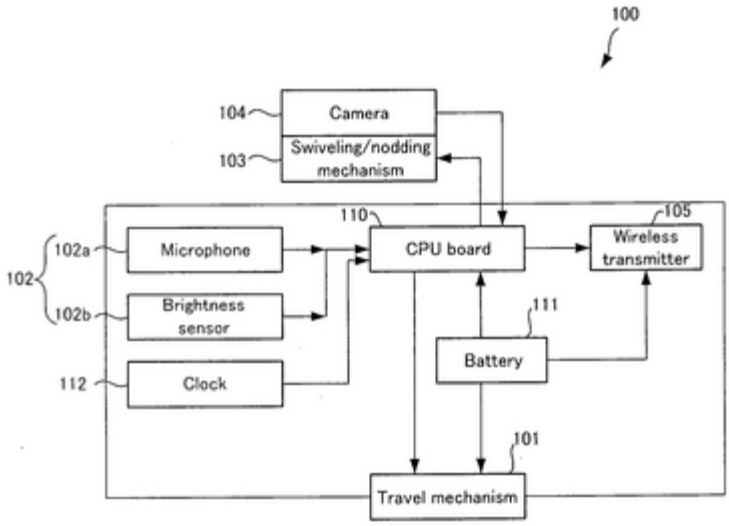

Figure 2.1: Configuration of the autonomous mobile robot

2.5 Fifth Review: Mobile Robot Sensor System.

An object of the present invention is to provide a sensor system which can effect local communications suitable for exchanging information to avoid collisions between mobile robots. The sensor system also prevents collisions between the mobile robots and obstacles. The system is well-suited for a multi-robot environment where multiple mobile robots operate. The system includes infrared signal transmitters installed in each of the multiple mobile robots for sending transmission data via infrared signals. The system further includes infrared signal receivers installed in each of the multiple mobile robots for receiving the transmission data sent by the infrared signal transmitters. Each mobile robot includes a control unit.

The control unit prepares transmission information which includes mobile robot identification information unique to the mobile robot. The

transmission information is included in the transmission data sent from the infrared signal transmitter. The control unit also extracts transmission information which is received by the infrared signal receiver.

2.6 Sixth Review: Mobile Robot for Monitoring a Subject.

A mobile robot with a diagram indicating a moving path of a subject and a diagram showing a connection between locations, is capable of generating a path on which a subject is predicted to move from information of the subject detected by a detector, a detecting direction of the detector along the path, or tracking the subject by tracing the path, and predicting a location of a destination of the subject even when the subject has moved to another location. Further, the robot is capable of determining an abnormality based on detected location of the subject.

(Refer Figure 2.2)

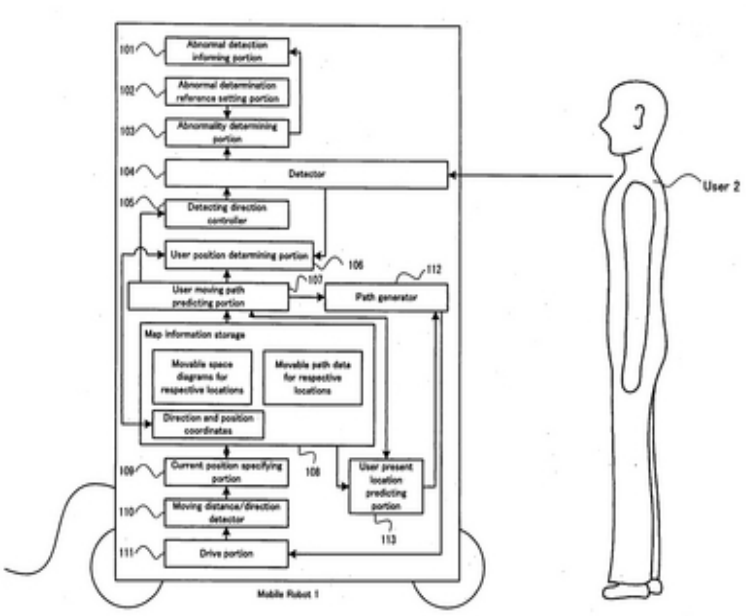

Figure 2.2: Functional block diagram according to a first embodiment of a mobile robot