HARDWARE CONSTRUCTION OF SEARCH AND RETRIEVAL, OBJECT DETECTION AND OBSTACLE AVOIDANCE ALGORITHM FOR A MOBILE ROBOT.

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18 NOVEMBER 2005

"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 (Industrial Power)"

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Dedicated to my dad Mohd Zin B.Hassan, my mom Fatimah Bte Othman, my brother Mohd Syafik B.Mohd Zin and my fiancé Abd.Khairil Rani B.Hj Fadzali for their love, patient and understanding.

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ABSTRACT

This project is about hardware construction of search and retrieval, object detection obstacles avoidance algorithm for a mobile robot. The function of this robot is to detect the object automatically within 3 metes. It also used PIC 16F8777 microcontroller to control this mobile robot. In design the body of this robot, wastedt materials has been used in order to minimize the overall cost.. Infrared (IR) system will be used in this project in order for the mobile robot to detect the object. IR transmitter will be placed on the object, while on the other end, IR receiver will be attached to the input port of the microcontroller. When the robot received the signal from the transmitter, it will move towards the object. This robot purposely being built up to help human to cope with the dangerous situation which is beyond human ability such as to perform task at high building area, to disable a bomb or to put out fire.

ABSTRAK

Projek ini adalah tentang pembinaan perkakasan robot yang boleh mencari dan mengesan objek.Fungsi utama robot ini adalah untuk mengesan objek secara automatik pada jarak 3 meter. Ia juga menggunakan pengawal mikro PIC16F877 sebagai nadi utama untuk mengawal robot ini.Dalam bentuk badan robot ini, bahan terbuang digunakan untuk meminimakan kos keseluruhan. Sistem infrared (IR) digunakan untuk mengesan objek dimana IR *transmitter* diletakkan pada objek dan IR *receiver* disambungkan pada pengawal mikro. Apabila robot menerima signal daripada *transmitter* , ia akan bergerak ke depan.Robot ini dibangunkan bertujuan untuk menolong manusia menyelesaikan perkara-perkara yang merbahaya kepada manusia seperti bekerja di tempat tinggi, mengambil bom dan memadamkan kebakaran

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

A robot is a reprogrammable, multifunctional manipulator designed to move materials, parts, tools or specialized devices, through variable programmed motions for the performance of a variety of tasks. It is also any device which can replaces human labor [9].For example if the robot use in factory it can help to reduced cost, increased productivity and improved product quality.

Nowadays robot is very important to us especially in industries, entertainment aerospace, agriculture and to help human to cope with the dangerous situation. Those entire activities can be done effectively and impressive with the energy of robots. However, research about robot still progress to improved until optimum applications.

In this project, the main exploration is about mobile robot which can detect object by using IR sensor and PIC Microcontroller. It is also to study about implementation of hardware and robot behaviors that can detect object within 3 meters. In this project, the intelligent robot by using infrared system will be produced.

1.2 PROJECT OVERVIEW

This project is to construct the hardware of search and retrieval, object detection obstacles avoidance algorithm for a mobile robot. It's also constructed by using software and hardware. For hardware, this project needs to build the mobile robot, design and complete IR sensor circuit and motor circuit. Infrared system is the one of the important part to make the robot can detect object. For the motor circuit, twin motor gearbox is used. The software of used in this project is MPlab that has been used to program the PIC 16F877Microcontroller.

1.3 OBJECTIVE

Implementation of hardware to produce a mobile robot that can detect an object automatically in 3 meters range

1.4 SCOPE

This project is to implement hardware for mobile robot which can detect object in 3 meters. It also has been built by dc motor, infrared system and a microcontroller. All the program are uploaded into the controller to make its own decision and determine the position.

1.5 PROBLEM STATEMENT

a) How to make sure that the object can be detected by the robot at least within 3 meters range

b) How to minimize the construction cost of the robot

c) How to build the motor system for the robot in order to make it mobile?

d) How to design and construct the IR circuits for transmitter and receiver?

Obstacle avoidance mobile robots today usually make the collision with other object. It can make the body of robot damage before turn around. In order to avoid this situation, Infrared system is built to safe it and can detect object clearly. To minimize the construction cost, wasted materials will be used in this project.

1.6 PROJECT METHODOLOGY

1. Analyze and do research about hardware of mobile robot
2. Choose the right wasted materials that can be used as chassis
3. Design and construct the motor system
4. Design and construct IR transmitter and receiver circuit
5. The mobile robot will be tested to get the distance in 3 meters
6. If there any problem, troubleshooting is needed
7. Finally do a complete set of report

1.7 EXPECTED RESULT

Constructed Hardware of the robot that can detect an object within 3 meters successfully by using infrared system.

1.8 REPORT OUTLINES

This project report has 6 chapters. Chapter 1 gives some introduction, objective and overview for this project. Chapter 2 is literature review that explains about the related work that has been done by other people. For chapter 3 is about hardware implementation

For project constructions which are including about dc motor, infrared system and power supply are in chapter 4.Analysis and experiment about infrared is in chapter 5 and conclusion with discussion in chapter 6.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Robot can be classified in two categories that are mobile robot and fixed mobile robot. The purpose of this chapter is to explain perspective and method are used for the previous project mobile robots which are mostly used in difficult task or dangerous environment. It also can review existing technique and theory of mobile robot.

2.2 ROBOT

The word robot comes from Czech word "robota" means forced labor by the Czech writer Karel Capek in1921. According to the Webster dictionary it means:
"An automatic device that performs functions normally ascribed to human or a machine in the form of a human (Webster, 1993)".[7]

2.2.1 A Short History of Robots

Robot Timeline (Source from the http://www.robot.com/history.htm)

1 .~270BC - an ancient Greek engineer named Ctesibus made organs and water clocks with movable figures.

2. 1818 - Mary Shelley wrote "Frankenstein" which was about a frightening artificial lifeform created by Dr. Frankenstein.

3. 1921 - The term "robot" was first used in a play called "R.U.R." or "Rossum's Universal Robots" by the Czech writer Karel Capek. The plot was simple: man makes robot then robot kills man!

4. 1941 - Science fiction writer Isaac Asimov first used the word "robotics" to describe the technology of robots and predicted the rise of a powerful robot industry.

5. 1942 - Asimov wrote "Runaround", a story about robots which contained the "Three Laws of Robotics":

   - A robot may not injure a human, or, through inaction, allow a human being to come to harm.
   - A robot must obey the orders it by human beings except where such orders would conflic with the First Law.
   - A robot must protect its own existence as long as such protection does not conflict withe the First or Second Law.

6. 1948 - "Cybernetics", an influence on artificial intelligence research was published by Norbert Wiener

7. 1956 - George Devol and Joseph Engelberger formed the world's first robot company.

8. 1959 - Computer-assisted manufacturingg was demonstrated at the Servomechanisms Lab at MIT.

9. 1961 - The first industrial robot was online in a General Motors automobile factory in New Jersey. It was called UNIMATE.

10. 1963 - The first artificial robotic arm to be controlled by a computer was designed. The Rancho Arm was designed as a tool for the handicapped and it's six joints gave it the flexibility of a human arm.

11. 1965 - DENDRAL was the first expert system or program designed to execute the accumulated knowledge of subject experts.

12. 1968 - The octopus-like Tentacle Arm was developed by Marvin Minsky.

13. 1969 - The Stanford Arm was the first electrically powered, computer-controlled robot arm.

14. 1970 - Shakey was introduced as the first mobile robot controlled by artificial intellence. It was produced by SRI International.

15. 1974 - A robotic arm (the Silver Arm) that performed small-parts assembly using feedback from touch and pressure sensors was designed.

16. 1979 - The Standford Cart crossed a chair-filled room without human assistance. The cart had a tv camera mounted on a rail which took pictures from multiple angles and relayed them to a computer. The computer analyzed the distance between the cart and the obstacles.

Table 2.1: Consideration between Human and Robot

HUMAN	EYE	LEGS	BRAIN
ROBOT	SENSORS	WHEELS	CONTROLLER

2.2.2 Mobile Robot

Mobile robot means a robot that can moves from one place to another to complete their task. It is very important to help human in many cases. Mobile robot has many kinds like wheeled, tracked, legged robot. It also has three main parts known as processor, motor controller and sensor.

2.2.3 Modern uses of Robots

1) Exploration

People are interested in places that are sometimes full of danger, like outer space, or the deep ocean. But when they can not go there themselves, they make robots that can go there. The robots are able to carry cameras and other instruments so that they can collect information and send it back to their human operators.

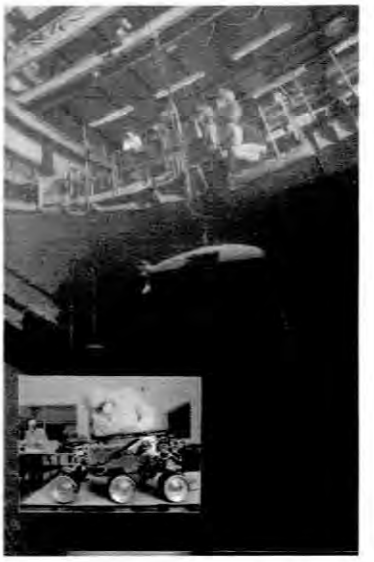

Figure 2.1: The robot called "Odyssey IIb" shown in a tank. It was developed by research scientist at M.I.T for ocean exploration (from National Geographic, July 1997).

2) Industries

When doing a job, robots can do many things faster than humans. Robots do not need to be paid, eat, drink, or go to the bathroom like people. They can do repetitive work that is absolutely boring to people and they will not stop, slow down, or fall to sleep like a human. [9]

Figure 2.2: Industrial robots spot weld automobile bodies on an assembly line