SEARCH AND RESCUE ROBOT

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MAY 2007

"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 and Automation)"

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Supervisor's Name : Mariam Bt Md Ghazaly

Date : 7 May 2007

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Faculty of Electrical Engineering

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

Signature : .....

Name : Zaid Bin Mohd Ismail

Date : 7 May 2007

For my beloved family

ABSTRACT

This proposal presents a design and implementation of a rescue robot. It a basic operation system of any rescue robot that already been made. The main task of the robot is to detect the human temperature and send a signal to the rescuers for rescue operation. The robot will be equipped with several sensors such as negative temperature coefficient sensor (NTC) and bump sensor.

In controlling the robot it requires a 16F877A PIC microcontroller which will be programmed using MikroC, PROTEUS for circuit designing and IC Prog for burner or loads the programming into the microcontroller. It also use L293 as a motor driver to control the rotation of the DC motor.

The unstructured terrain or landscape at the area will need the robot using a suitable wheel such as tank wheels. By using 9V DC motor and large wheel the robot should be able to move around unstructured landscape and able to climb over the pile of collapse building or ruin.

ABSTRAK

Laporan ini adalah berkaitan tentang merekabentuk dan menghasilkan robot penyelamat. Robot yang akan dihasilkan adalah robot penyelamat yang hanya mmpunyai ciri-ciri asas suatu-suatu robot penyelamat. Tugas utama robot ini adalah untuk mengesan haba mnusia dan menghantar isyarat kepada penyelamat untuk menjalankan kerja-kerja menyelamat. Robot ini akan dilengkapkan dengan beberapa pengesan seperti pengesan haba inframerah dan suis pengesan.

Dalam mengawal robot ini ia memerlukan 16F877A Microcontroller dimana ia akan di programkan menggunakan perisian MikroC. Perisian PROTEUS 6 Professional digunakan untuk melukis litar dan manakala perisian IC Prog digunakan untuk memindahkan data atau memuat turun data ke Microcontroller. Robot ini juga akan menggunakan L293 sebagai pengawal motor, dimana ia akan mengawal arah pusingan motor DC tersebut.

Robot ini akan beroperasi secara automatik yang berupaya bergerak sekeliling kawasan dan mencari mangsa-mangsa. Pergerakan robot ini adalah berpandukan daripada isyarat yang dihantar daripada pengesan-pengesan ssekeliling robot dan robot ini hanya beroperasi pada kawasan dan keadaan terkawal sahaja.

TABLE OF CONTENT

CHAPTER 3:METHADOLOGY

CHAPTER 4:PROJECT RESULT

LIST OF FIGURE

LIST OF TABLE

LIST OF ABBREVIATIONS

PSM	Projek Sarjana Muda
PIC	Programmable Integrated Circuit
LED	Light Emitter Diode
PTC	Positive Temperature Coefficient
NTC	Negative Temperature Coefficient
DC	Direct Current
IR	Infra Red
NC	Normally Close
NO	Normally Open

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

1.1 Introduction

Human rescuers have very short time (about 48 hours) to find trapped victims in a collapsed structure otherwise the chance of finding victims still alive is nearly zero. In such a critical situation technology can make a great help for rescuers. Intelligent mobile robots and cooperative multi-agent robotic systems can be very efficient tools to speed up search and rescue operations. Rescue robots are also useful to do rescuing jobs in situations that are hazardous for human rescuers. They can enter into gaps and move a trough small hole that is impossible for humans and even trained dogs. Robots should explore in collapsed structure, extract the map, search for victims and report the location of victims in map and way that rescue team can reach him/her. It can also place a small package containing food, drugs and a communication device near the victim.

A search and rescue robot can have many features. One of the most important features from this robot is equip with a humidity and temperature sensors to detect the temperature of the victim. This particular search and rescue robot will be driven automatically using several sensors. The input from the sensors will be send to the motor to change the direction of the robot. Once the robot reach the victim, the robot then will alarm the rescuer by active the buzzer from the robot.

The research and rescue robot is no longer an competition or luxury type of robot. Instead, it is a resource that can be used by many. Due the natural disasters such as earthquakes and tornadoes, and various types of incident involve collapse building, development of search and rescue robots are essential.

1.2 Objective

To complete the project successfully some aim need to be made as a guideline and the objective of this project is;

i. To build a basic type of search and rescue robot that able to move base on input from the sensor or limit switch.
ii. The robot will react or give a response after it detects a heat.
iii. To use the mikroC and PROTEUS as a program to complete the robot system.
iv. To develop a small and compact robot.

1.3 Scope of The Project

The function of project scope is to identify the criteria that should have at the project and this will help the project to accomplish by following the track. The scope of this project is to pattern and develop a Search and Rescue Robot. There will be a several scope or section to accomplish before completes the project, as long as the project is within the project scope the project will be success.

The first scope is to develop a simulation circuit for the robot by using Proteus 6 software to create the circuit and MikroC software to create the program for the robot. The circuit been made should capable to control the movement of the robot or motor, capable to active the sensor for searching and rescuing the victim and the circuit will only operate under a control environment.

The second scope of this project is to develop the body for the robot as small as can. The small body of the robot will give an advantage for searching the victim

through a small hole or place. The pattern of the body will be made by referring the position of all hardware such as the sensors and the motor.

The third scope is combining the circuit with the hardware and installs it in the body of the robot. The robot then need to be calibrated to assure it works properly by adjusting the sensors or the motor.

1.4 Problem Statement

In the past two decade it is estimated that the disasters are responsible for about 3 million death worldwide, 800 million people adversely affected and property damage exceeding 50 billions dollar. The close example is Tsunami and earthquake, which a collapse building is a normal tragedy for the disasters. Rescuers will spend a lot of time to search and rescue for survivors, this is because the risk that the rescuers will face, any mistakes could endanger their own life. For example unstable ground or floor and collapse structure are extremely dangerous for the rescuers especially in the case of earthquake after shock. Because of this problem and risk that will harm the rescuers, the search and rescue operation more often recover dead bodies than live ones. Table 1.1 shows the project planning for this project.

PERANCANGAN PROJEK
PROJECT PLANNING

Senaraikan aktiviti-aktiviti utama bagi projek yang dicadangkan. Nyatakan jangka masa yang diperlukan bagi setiap aktiviti.
List major activities involved in the proposed project. Indicate duration of each activity to the related month(s).

	2006							2007					
Aktiviti Projek *Project's Activities*	J	J	A	S	O	N	D	J	F	M	A	M	J
Search for information about robot especially Search and Rescue Robot.		X											
earning about programming the robot by using C rogramming and PIC Lite.		X	X										
tart using and learning PROTEUS program for designing a ontrol circuit.			X	X									
uild the circuit and burn the program using IC Prog into icrocontroller			X	X	X								
resentation of PSM 1				X									
lake a research and surveys for hardware/circuit component			X	X	X	X	X	X					
nstalling the hardware and make the electrical connection of sensor.						X	X	X	X				
Testing and calibration of the robots									X	X			
Presentation of PSM 2											X		

Table 1.1: Project Planning Gant Chart

CHAPTER 2

LITERATURE REVIEW

2.1 Search and Rescue Robot 1

The paperwork "Design Features and Characteristics of a Rescue Robot" by Amon Tunwannarux and Supanunt Hirunyaphisutthikul is about to design and implementation of rescue robot for Thailand Search and Rescue Robot Championship. In this paperwork it mention roughly about the robot such as the robot pattern, type of sensor they use, the robot controlling unit and the operator monitoring unit. In this invention, the robot is controlled by joystick and also the robot has two front arms with tracks, and tracks link between front and rear wheels. With this tracked dual rotating arms feature, it allows the robot easily to climb over the pile of collapse. The robot also is equipped with a pan / tilt camera and several sensors such as infrared temperature sensor, voice sensor, infrared distance sensor, odometer sensors and compass sensor. For a perfect viewing and searching for the victim, the robot were added a mast on at the rear part of robot body. At the top of the mast, the color CCD camera and a small pan/tilt mechanism been placed. The robot pattern is show as Fig. 2.1.

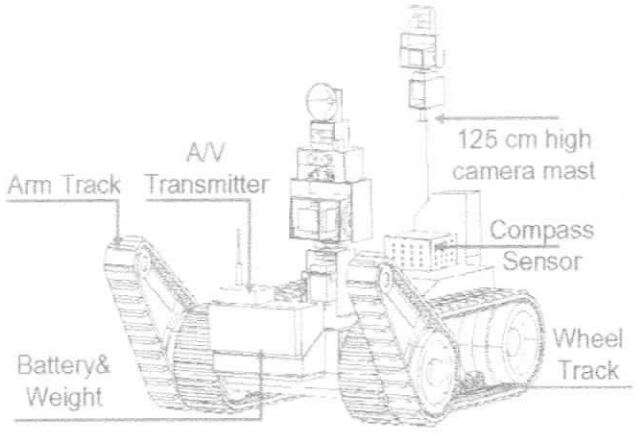

Figure 2.1: Search and Rescue Robot

Another ability of this robot is capable to climb a stairwell. By using the arm track, the front body can be rise up to climb the stair and the battery at the front of the body is use as weight transfer. The operation of the robot while at the stairs as shown in Fig. 2.2

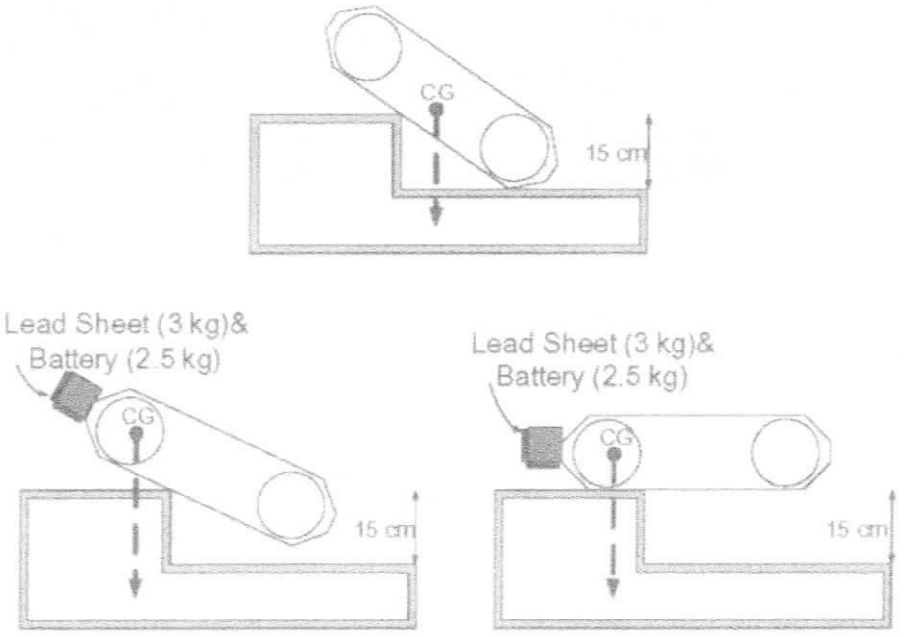

Figure 2.2: Operation of weight transfer unit

2.2 Search and Rescue Robot 2

The paperwork "Search and Rescue robot" written by Shannon Zelinski and Chris Cortopassi is about the project on how the search and rescue robot works to complete the task. The task is to search for block within contained rectangular area and once found, the robot pickup the block and return to the starting point. In this paperwork it also mentions about the robot movement such as snakes search pattern too complete the task. The movement like 'S' is the solution for this robot to search for the block. Then once the robot found the block, the robot will begin to collect the block and the robot will move back to the starting point. The movement is shown in the fig. 2.3 and fig. 2.4.

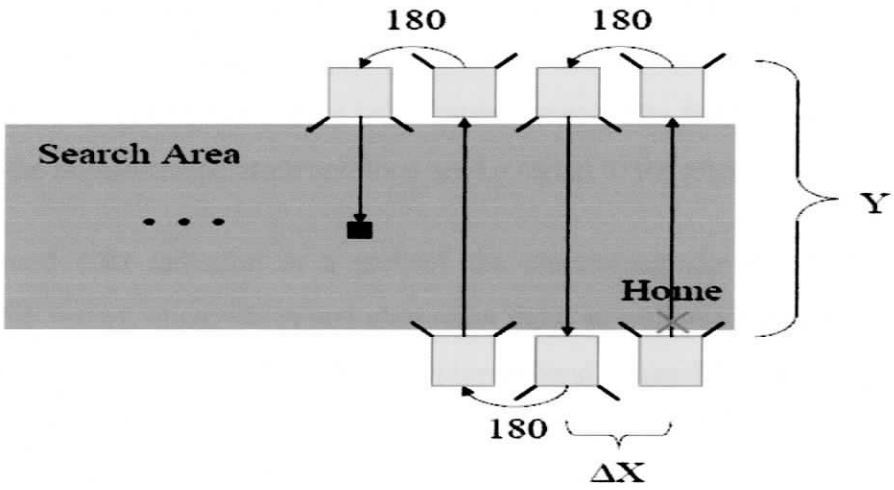

Figure 2.3: Snake Search Pattern

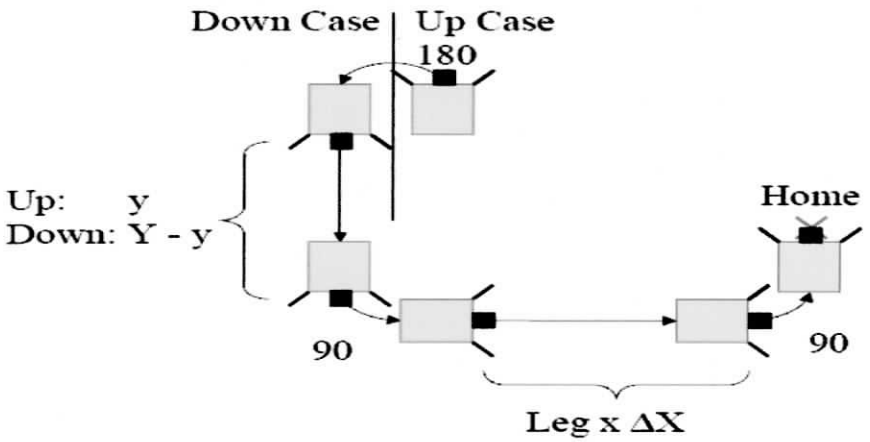

Figure 2.4: Rescue Pattern

2.3 Infrared (IR) Temperature Sensor

In any search and rescue robot, temperature sensor is the most comment or important sensor should have equipped at the robot. In the word, even a basic search and rescue robot at least must have a temperature sensor. The function of this sensor is to detect the human temperature and then send a signal to the microcontroller.

Infrared (IR) radiation is a part of the electromagnetic spectrum, which includes radio waves, microwaves and ultraviolet light, as well as gamma rays and X-rays. For an IR sensor, only the 0.7 - 14 micron band is used for IR temperature. Using an advanced optic system and detector, non-contact IR thermometers can be focus on nearly portion or portions of about 0.7 – 1.4 micron band. This is because every object has an optimum amount of IR energy at a specific point along the IR band.

Roughly how the temperature sensor work is the emitted energy comes from an object and reaches the IR temperature sensor through its optical system. The energy will focus onto one or more photosensitive detectors and will convert the IR energy into an electrical signal, which is in turn converted into a temperature value based on the sensor's calibration and target's emissitivity. Figure 2.5 and 2.6 below shows an example of infrared temperature sensor.

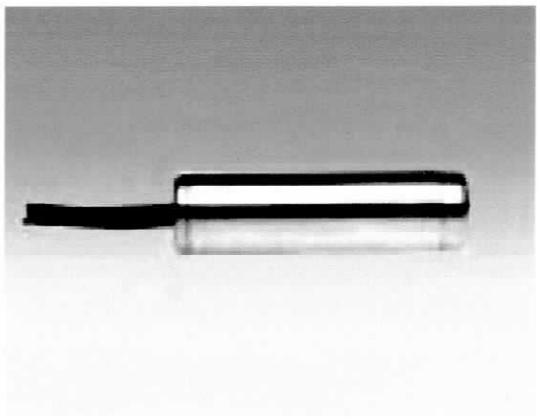

Figure 2.5: Example of Non-contact IR Temperature Sensor

Figure 2.6: Example of Temperature Sensor device