MONITORING MOBILE ROBOT

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Bachelor of Mechatronics Engineering

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MONITORING MOBILE ROBOT

KAMARULZAMAN BIN SANTUSO

A report submitted in partial fulfillment of the requirements for the degree of Bachelor of Mechatronics Engineering

Faculty Of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2009

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“I hereby declare that I have read through this report entitle “ Monitoring Mobile Robot” and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Mechatronics Engineering”

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Supervisor’s Name : …….

Date : …….

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I declare that this report entitle “Monitoring Mobile Robot” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : …….

Name : …….

Date : …….

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To my beloved father and mother

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First and foremost, I would like to say my gratitude to the one and only to our mighty God, Allah S.W.T. for giving me the strength, good health and talent to complete this project report.

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ABSTRACT

Applications of computer in control system are increasing due to development of information technology. As the most sophisticated and versatile mode of controlling, it is used widely in any field that involves controls task. The integration of data sending and radio frequency signal transmission has been applied in this project. The switching concept is used to controls the mobile robot at the transmission range. This project used serial communication to communicate with the external controller. The microcontroller circuit is chosen as the interface media between serial port at the computer and the external controller. Using Visual Basic 6.0 software as the internal controller, the signal is interpreted in a form machine language and is transmitted as a signal in a serial mode. The video capturing task is done by a wireless camera attached at the mobile robot and received by AV receiver to be displayed at the computer.

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ABSTRAK

Penggunaan komputer di dalam sistem kawalan semakin meningkat akibat daripada pembangunan dalam teknologi maklumat. Sebagai sebuah mod pengawalan yang serba guna dan canggih, ia banyak digunakan dalam apa jua bidang yang melibatkan tugas pengawalan. Integrasi antara penghantaran data dan penghantaran isyarat gelombang radio telah diaplikasikan dalam projek ini. Konsep pensuisan digunakan untuk mengawal pergerakan robot dalam kawasan lingkungan transmisi. Projek ini menggunakan komunikasi sesiri untuk berhubung dengan pengawal luar. Litar pengawal mikro telah dipilih sebagai pengantaramuka diantara 'serial port' pada komputer dengan pengawal luar. Menggunakan perisian Visual Basic 6.0 sebagai pengawal dalaman, isyarat diterjemahkan di dalam bentuk yang difahami oleh komputer (bahasa mesin) dan dihantar sebagai isyarat dalam mode sesiri. Tugas mengambil video dilakukan oleh kamera tanpa wayar yang dipasangkan pada robot bergerak and diterima oleh AV receiver untuk dipaparkan pada komputer.

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CHAPTER I

INTRODUCTION

1.1 Introduction

The word "robot" originates from the Czech word for forced labor, or serf. It was introduced by playwright Karel Capek, whose fictional robotic inventions were much like Dr. Frankenstein's monster -- creatures created by chemical and biological, rather than mechanical, methods. But the current mechanical robots of popular culture are not much different from these fictional biological creations.

Basically a robot consists of:

- A mechanical device, such as a wheeled platform, arm, or other construction, capable of interacting with its environment
- Sensors on or around the device that are able to sense the environment and give useful feedback to the device
- Systems that process sensory input in the context of the device's current situation and instruct the device to perform actions in response to the situation

In the manufacturing field, robot development has focused on engineering robotic arms that perform manufacturing processes. In the space industry, robotics focuses on highly specialized, one-of-kind planetary rovers. Unlike a highly automated manufacturing plant, a planetary rover operating on the dark side of the moon -- without radio communication -- might run into unexpected situations. At a minimum, a planetary rover must have some source of sensory input, some way of interpreting that input, and a way of modifying its actions to respond to a changing world. Furthermore, the need to sense and adapt to a partially unknown environment requires intelligence (in other words, artificial intelligence).

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From military technology and space exploration to the health industry and commerce, the advantages of using robots have been realized to the point that they are becoming a part of our collective experience and everyday lives.

They function to relieve us from danger and tedium:

- Safety: Robotics have been developed to handle nuclear and radioactive chemicals for many different uses including nuclear weapons, power plants, environmental cleanup, and the processing of certain drugs.
- Unpleasantness: Robots perform many tasks that are tedious and unpleasant, but necessary, such as welding or janitorial work.
- Repetition and precision**:** Assembly line work has been one of the mainstays of the robotics industry. Robots are used extensively in manufacturing and, more glamorously, in space exploration, where minimum maintenance requirements are emphasized.

1.2 Problem Statement

In a situation where monitoring job is done, the use of human for doing this job is not suitable when it comes to certain condition like at a dangerous environment such as radioactive place, exploration of new places or at war because the safety of human in not ensured. Injury or accident often occurs during monitoring task that done by human. This situation that didn't ensure human safety needs an alternative as a replacement to human for doing monitoring task so that the safety of human will be ensured while the monitoring process is done.

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1.3 Objectives

Since this project is about mobile robot, so the objective is to design a mobile robot that capable to monitor the situation and send visual data to the user. This mobile robot can be controlled from certain distance by using a radio wave frequency that controlled via a computer, so the user didn't need to go to the place that is monitored. Based to this concept, the safety of the user will be ensured. Besides that, the knowledge about radio frequency circuit operation as one of the existing controller can be gained. With several modifications, this circuit can be integrated with other devices such as computer to upgrade the control system as desired by the user. Other objective is to expose the use of serial data transmission as the component of controller system besides the commonly used parallel transmission.

1.4 Scope of the Project

The scope of the project is to design a mobile robot that can be controlled form a safe location in a transmission range as well as capturing visual of the monitoring environment. The basic of the robot is that a wireless camera will be attached to the robot, so the area around the mobile robot can be captured and send to the receiver and it will be displayed via a computer. The mobile robot will be controlled by the computer through a graphical user interface (GUI). The guide for the user in navigating the mobile robot is through the visual received from the camera. In this project, the area that the camera able to capture is about 5 meters square.

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1.5 Project Overview

To ensure that the project is finish within the times that have been given, a schedule is made and can be divided into PSM 1 and PSM 2. PSM 1 consists of a research information and reference made about mobile robot and also research about the current design and technology used to design and develop the mobile robot. The project activities contain the information gathering, literature review, hardware design, selecting parts for the project, software programming, circuit simulation and PSM 1 report writing. For the PSM 1, literature review is done in four month starting from June until September 2008. The hardware design and circuit simulation is done beginning from August until October 2008. The selection of the part started in September until November 2008 and finally the software programming and circuit simulation is done in November until December 2008. Then for the PSM 2 schedule, assembling the parts to form a complete hardware is carried in December 2008 until February 2009. Then the process of testing and troubleshooting is done in February until March 2009. Lastly, project finishing and thesis writing is started at March 2009.

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CHAPTER II

LITERATURE REVIEW

2.1 Robots

A robot is a mechanical or virtual artificial agent. In practice, it is usually an electro-mechanical system which, by its appearance or movements, conveys a sense that it has intent or agency of its own. The word *robot* can refer to both physical robots and virtual software agents, but the latter are usually referred to as bots. There is no consensus on which machines qualify as robots, but there is general agreement among experts and the public that robots tend to do some or all of the following: move around, operate a mechanical arm, sense and manipulate their environment, and exhibit intelligent behavior, especially behavior which mimics humans or animals.

Stories of artificial helpers and companions and attempts to create them have a long history, but fully autonomous machines only appeared in the 20th century. The first digitally operated and programmable robot, the Unimate, was installed in 1961 to lift hot pieces of metal from a die casting machine and stack them. Today, commercial and industrial robots are in widespread use performing jobs more cheaply or with greater accuracy and reliability than humans. They are also employed for jobs which are too dirty, dangerous or dull to be suitable for humans. Robots are widely used in manufacturing, assembly and packing, transport, earth and space exploration, surgery, weaponry, laboratory research, and mass production of consumer and industrial goods.

People have a generally positive perception of the robots they actually encounter. Domestic robots for cleaning and maintenance are increasingly common in and around homes. There is anxiety, however, over the economic impact of automation and the threat of robotic weaponry, anxiety which is not helped by the many villainous, intelligent,

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acrobatic robots in popular entertainment. Compared with their fictional counterparts, real robots are still benign, dim-witted and clumsy.

2.2 Past Projects Review

In the construction of this project, some past projects review have been carried out. The technical part and the operation system is evaluated and taken considerations in generating new ideas as well as making this project unique. The characteristics and scope of this project is likely as the past projects but the hardware and software development is different. In this section, there are nine past project listed and briefly described.

2.2.1 First Review: Computer Controlled RC Car by Ashish Derhgawen

This project is made by a student name Ashish Derhgawen from Bangalore, India. The project idea is modification of RC car remote controller for enabling it to works with computer. A transistor circuit acts as an interface between the parallel port and the remote control. The transistor is soldered at the output point of the remote control IC and the ground point. The current from IC output will flow from the collector through the emitter of the transistor the connected to the circuit's ground when the base gets signal from the parallel port. There are four BC 547 transistors used for each motion of the RC car. This project uses GUI for communicates with the parallel port and the hardware. This project scope of application is at the room and not for outdoor environment.

Figure 2.1: Connections of wires at the controller

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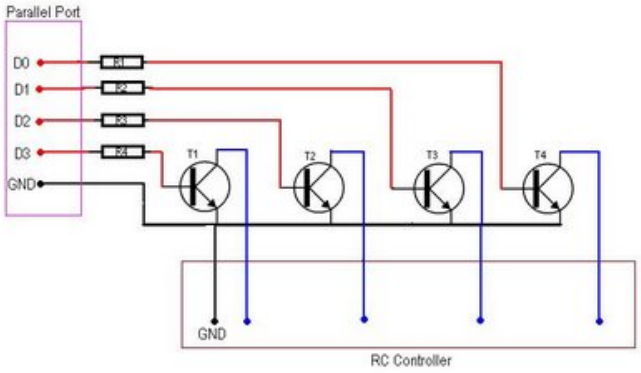

Figure 2.2: Transistors circuit schematic design

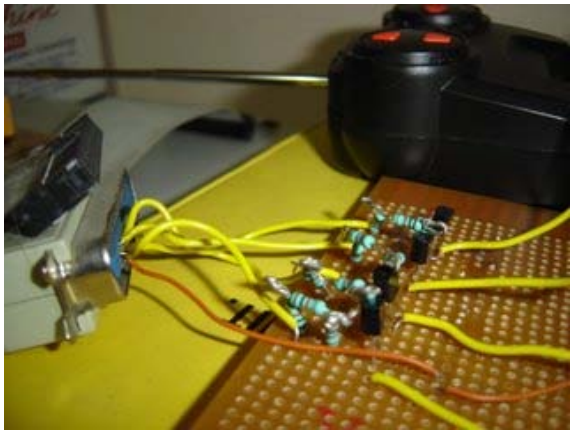

Figure 2.3: Connections between transistor circuit and parallel port

2.2.2 Second review: Computer Controlled RC Car by Jonathan Bennet

This project is made by a student name Jonathan Bennet at University of Waterloo. This project uses parallel port to communicate with the computer. The concept of this project is modification of the RC Car controller. As for the connection between the controller and parallel port, wires are used. It is soldered to each of the four buttons and one wire to the common ground. The construction of parallel port cable is done by using standard parallel port connector, four 2N3904 transistor, solder board and floppy drive cable, the base of the transistor is connected to one pin of the parallel port. The collector pin is connected to the remote control output and emitter pin is connected to the common

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ground point. The software construction of this project consist programming of QBasic that are compatible with the parallel port control.

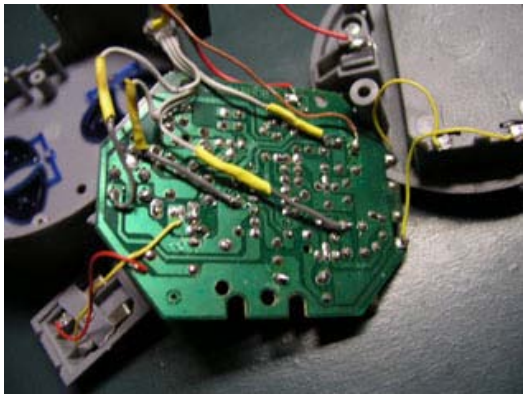

Figure 2.4: Wiring modifications on RC controller

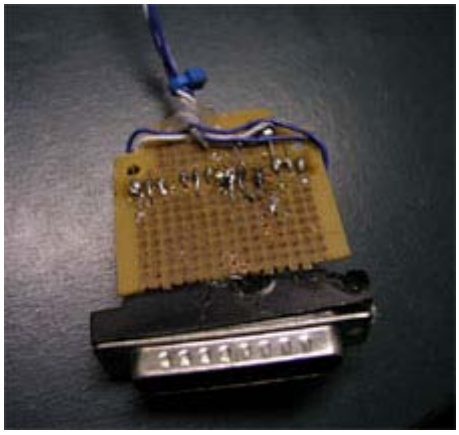

Figure 2.5: Parallel port modifications

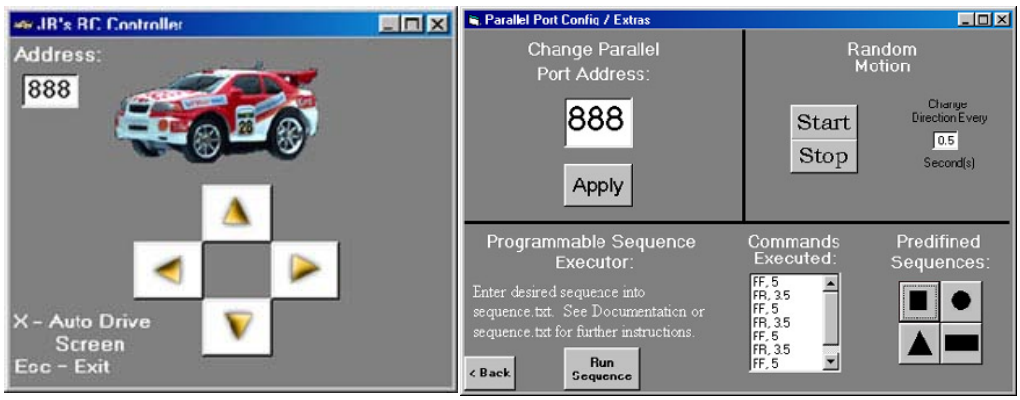

Figure 2.6: GUI of the project

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2.2.3 Third Review: Computer Controlled RC Car by Nasa Tjan and Ellias Ismail

This is a final year project of Nasa Tjan and Ellias Ismail, student of Malaysia Campus of the University of Nottingham. The project software components are written in Java. The interface for connecting between computer and hardware is the interface board that is 8/8/8 PhidgetInterfaceKit from Phidgets.com that are connected via transistors and relays to the remote control. The Logitech brand webcam is used as a video capture device. The webcam is pointed at the car so the user can see the car through the display at the computer.

Figure 2.7: 8/8/8 PhigetsInterfaceKit

2.2.4 Fourth Review: Computer-Controlled R/C Car with Camera by Coding4Fun

This project use PhidgetInterfaceKit 0/0/4 as an interface between the computer and RC controller. There are some modifications done to enable the RC controller to be interface with the Phidget controller that is the hand-held controlling unit to receive input and produce signal to the RC car. The RC controller used in this project is digital input type. The connection between the Phidget controller and RC controller is simply done by soldering one end of the wire at the input point of the RC controller and screwing one end at the screw terminals of the Phidget interface board. The camera of this project is battery powered Airlink 101 AIC-250W. This camera requires 5V to operate. The software used is Microsoft C# and Microsoft Robotics Studio.

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