ROBOTIC ARM SPY TANKER

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Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
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Date : 25 April 2007

Special dedication to my loving parents
En. Abd Rahman b. Haji Khamis and Pn. Zawiah bt Mas'od,
my siblings, my kind hearted supervisor Mr Sani Irwan bin Md Salim,
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ABSTRACT

In this project, a prototype called 'Robotic Arm Spy Tanker' is developed to operate several functions such as to take or hold an object and also to move an object to another position. This prototype used DC motors for movement in every angle of the Robotic Arm. In this case, five DC motors are used for the movement of Robotic Arm and another two DC motors are used for the movement of the wheels. The prototype is controlled using a computer through an interfacing program developed. RF Transmitter-Receiver is used as a wireless connectivity between the prototype and the computer. The distance between prototype and computer is limited by the range of the RF transmitter-receiver. The prototype is established by combining the hardware and software in order to function completely.

ABSTRAK

Sebuah prototaip yang dinamakan '*Robotic Arm Spy Tanker*' dibangunkan dalam projek ini untuk menjalankan fungsi seperti untuk mengambil, mengangkat dan memindahkan objek dari satu tempat ke tempat yang lain bagi tujuan memudahkan sesuatu kerja. Prototaip ini menggunakan DC motor untuk pergerakan 'Robotic Arm'. Lima DC motor digunakan untuk mengawal bahagian lengan robot manakala dua DC motor digunakan untuk mengawal roda. Pergerakan prototaip ini dikawal menggunakan komputer mengikut kehendak pengguna berdasarkan kepada perisian yang dibina sebagai perantaramuka. Arahan daripada komputer tersebut dihantar ke prototaip robot melalui gelombang frekuensi radio (RF). Pengawal pada prototaip robot akan mentafsir arahan tersebut seterusnya melakukan pergerakan mengikut arahan yang diterima. Jarak kawalan pergerakan prototaip adalah terhad mengikut jarak penghantaran (*RF Tansmitter-Receiver*). Secara keseluruhannya, penggunaan perkakasan dan perisian digabungkan bagi membolehkan prototaip ini berfungsi sepenuhnya.

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LIST OF ABBREVIATION

LED - Light Emitter Diode
RF - Radio Frequency
DOF - Degree Of Freedom
PC - Personal Computer
PCB - Printed Circuit Board
IC - Integrated Circuit
DC - Direct Current

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CHAPTER I

INTRODUCTION

1.1 PROJECT SYNOPSIS

This project is designed to pick up or to move object from one place to another especially places that cannot be reach. It is a combination of robotic arm and a spy tanker, which is controlled by computer using wireless connection. The programming software that is going to be used is Visual Basic and function as the interface to control the robot movement. The arm and wheel motors are controlled by a controller where the signal is received from the computer to RF communication.

1.2 SCOPES OF WORK

The scopes for the project are:

i. The robot consists of four Degree of Freedom
ii. Control arm and wheel motor using Visual Basic software.
iii. Transmit data from computer to robot receiver to control its movement.

1.3 PROBLEM STATEMENTS

Normal spy tanker that has been developed before has several limitation that can be overcome in this project. Limited distance has been the main issue where the spy tanker cannot reach greater range to perform its duties. Other than that, inflexible robotic arms that posses fixed base and few degrees of freedom have cramp the versatility of the spy tanker.

1.4 PROJECT OBJECTIVES

The objectives of this project are:

i. To design and combine a robotic arm with spy tanker.
ii. To construct a wireless communication system using RF.
iii. To develop a robot that is controlled using Visual Basic software interface.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter discuss on the overall project theory and concept. The purpose of this is to explain the perspective and method that is used in previous research or projects and to classify how much this project relate with those research and theory. Moreover, this chapter will show the theory and concept used to solve the project problem. Theoretical understanding is very important as a guide in doing any kind of research.

2.2 THE LYNX 5 ROBOTIC ARM

The Lynx 5 robotic arm delivers fast, accurate, and repeatable movement. The robot features base rotation, shoulder, elbow and wrist motion, and a functional gripper. The Lynx 5 robotic arm is an affordable system with a time tested rock solid design that will last and last.

Figure 2.1: The Mechanics

The robotic arm is made from ultra-tough laser-cut Lexan structural components, black anodized aluminum servo brackets, and custom injection molded components. The arm assembly has ball bearings for improved accuracy. The arm includes five Hitec HS-422 servo motors; one for the base, two for the shoulder, and one each for the elbow and wrist. An HS-81 is included for the gripper.

2.2.1 Controlling the Arm

RIOS (Robotic arm Interactive Operating System) is a Windows program for controlling the L5 and L6 Robotic Arms with our SSC-32 servo controller. With RIOS, robot can be taught sequences of motion via the mouse or joystick. The inverse kinematics engine makes positioning the arm effortless. This extremely powerful program uses external digital and analog inputs to affect the robot's motion for closed loop projects. If-then, for-next, and do-while, are supported for the inputs. External outputs can also be controlled. This has been verified to work with an I/O Gear USB to serial cable. If stand alone operation is desired, RIOS/SSC-32 can actually create the BASIC code to control the arm from our Bot Board and Basic Atom or Basic Stamp 2. DB9 Serial Data Cable is included with L5AC-KT. Alternately the servo motors can be controlled directly from a microcontroller, such as an IsoPod.

2.3 CRUSTCRAWLER'S SG5-HT/UT

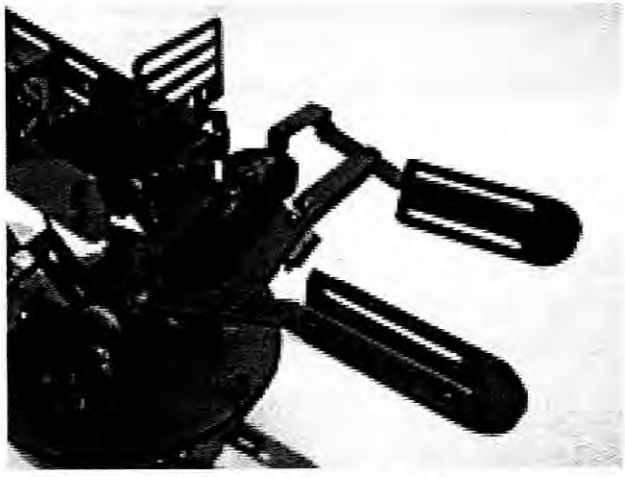

Figure 2.2: CrustCrawler's SG5-HT/UT

CrustCrawler's SG5-HT/UT series, load balanced, Robotic Arm featuring all aluminum construction and the only fully expandable "smart grip" design components. Feature for feature, the SG5 series presents the most powerful and sophisticated, all aluminum 5-axis robotic arm system available today. Although the 5-Axis Robotic arm is intended to be a stand alone system, the HexCrawler and QuadCrawler robots are compatible with the arm.

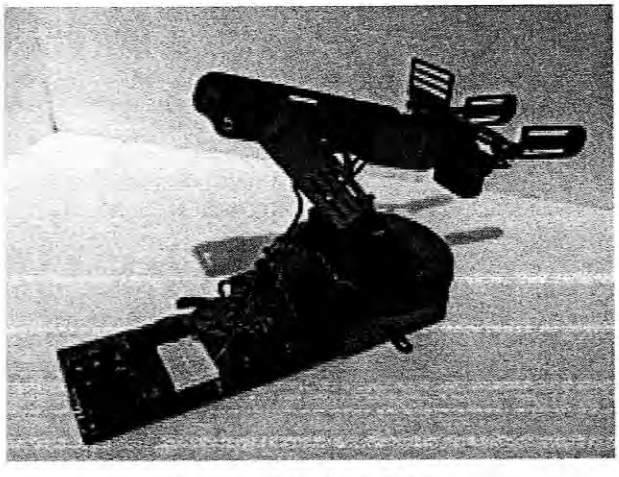

Figure 2.3: Side View

2.3.1 Key Features

All parts are precision CNC machined from 63 ga. 5052 brushed, sheet aluminum. The aluminum components are anodized to a smooth, scratch resistant, graphite finish using a type II anodizing process (the most impermeable finish next to military type III anodizing). All servo pivot points use integrated pem stud pivot points. Pem studs are cylindrically shaped aluminum spacers that are pressed into the aluminum with over 300 pounds of pressure. Unlike other manufactures tape or glue is not used in these critical stress areas.

Integrated pem nuts is used for ease of construction. Pem nuts are nuts that are pressed into the aluminum with over 200 lbs. of pressure. This makes construction much easier and faster. Pass thru holes and slots strategically located throughout the arm assembly for convenient wire routing. Two integrated SPST switches for convenient power routing to servos and supporting electronics. Three integrated mounting tabs for convenient attachment to robotic platform. It also accommodates all of the Parallax microcontroller boards including the BOE, BS2P40, BS2P24 and others.

The arm incorporates a custom engineered, counterbalanced retract system that effectively ensures maximum lifting and efficient servo power use both during operation and at rest. A counterbalanced arm is critical to ensure long servo life and maximum lifting power.

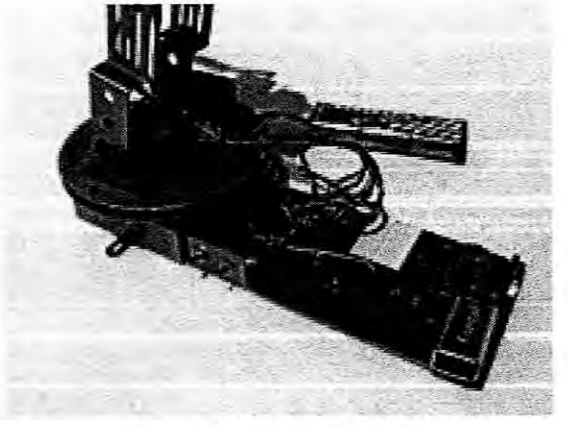

Figure 2.4: The Circuits

2.4 THE SERVO ERECTOR SET WITH BALL BEARINGS

Think of the Lynxmotion series of servo brackets as an Erector Set for servos. These components are extremely versatile, making virtually any mechanical arrangement possible. The brackets are available in black anodized or brushed finish. The ball bearings provide for precise low friction movement. The tubing, hubs and hub connectors are precision fit and really expand what is possible to build. It is made from high quality aluminum alloy. There is also a series of laser cut Lexan chassis, torso, and electronics carriers that truly complete the set.

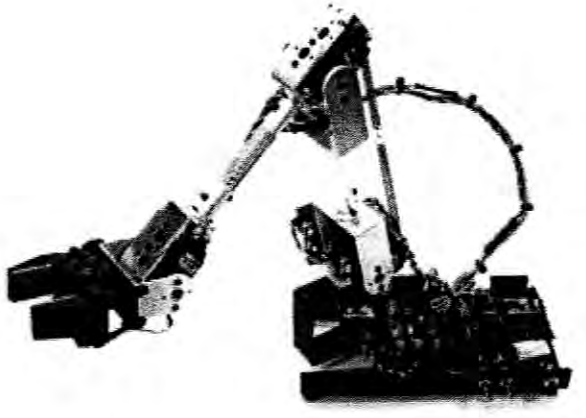

Figure 2.5: Servo Erector Set with Ball Bearings

An entire assembly can be build using just the components. Then populate the assembly with servos using only two screws for the servo horn, and four push in rivet fasteners to secure the servo body. This makes it surprisingly quick and easy to design and build rugged assemblies. Replacing a servo is effortless as the assembly doesn't need to be taken apart.