SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF POST GRADUATE STUDIES

DESIGN AND CONSTRUCTION OF LASER AND VIDEO TRACKING SYSTEM

A thesis presented for the degree of doctor of philosophy in laser physics

By: ABDELMONEIM MOHAMMED AWADELGIED

2003

بسم الله الرحمن الرحيم

((الله نور السماوات والأرض مثل نوره كمشكاة فيها مصباح المصباح في زجاجة الزجاجة كأنها كوكب دري يوقد من شجرة مباركة زيتونة لا شرقية ولاغربية يكاد زيتها يضيئ ولو لم تمسسه نار نور على نور يهدي الله لنوره من يشاء ويضرب الله الأمثال للناس والله بكل شيئ عليم))

صدق الله العظيم

الأية (35) من سورة النور

الخلاصة

اختصت الأطروحه بتصميم وبناء منظومة تتبع بواسطة الليزر ودراسة أدائها وكان ذلك بواسطة أشعة الليزر وبواسطة كاميرا ر قمية.

تتكون منظومة التتبع الليزري من الرأس الليزري، المنظومة البصرية، المنظومة الميكانيكية والالكترونية ودائرة الموائمة الالكترونية مع الحاسوب.

تم تهيئة كل جزء من أجزاء المنظومة أعلاه. أرسلت اشارة ليزرية من الرأس الليزري الى الهدف ومن ثم استقبلت الاشارة الليزرية بواسطة الجزء البصري وتم تحويلها الى اشارة ر قمية بواسطة دائرة الموائمة.

أستخدمت الكاميرا لمتابعة الهدف، واستخدم برنامج البسيك السريع للتحكم في حركة الهدف وحساب الاخطاء.

من مميزات هذه المنظومة علي المنظومات الاخرى أنها تجمع بين التتبع بواسطة أشعة الليزر والكاميرا وهذا يجعل د قة عالية للتعاون بين الوحدتين. كذلك أستخدمت اربع دوائر **ADC** وهذا يجعل التتبع سريع جداً بدلاً من استخدام دائرة واحدة. البرامج المستخدمة عندها ال قدرة على التعامل السريع مع الذاكرة.

ACKNOWLEDGEMENT

I am extremely grateful to my supervisors Professor Hajim, Dr. Kais A. Al-Naimee, Dr. Hussein A. Jawad, Mrs. Sheelan K. T and to the ILOG members for accepting to acts as supervisors, encouragement, fruitful suggestions, generous support through out the work.

I am indebted most of all to Dr. Nafii A. for his support, encouragement and arrangements of the thesis.

In preparing this work I have been assisted by and received from numerous individuals and institutions. I would like to detail and acknowledge:

I am under substantial intellectual debt to my colleague Mr. Abdel razig M. A/Bagi for his fruitful, greatly improved the quality of the designing the mechanical parts of the system.

There are many persons who sacrificed much to make, even in the most difficult circumstances, which the institutional co-operation work. I so much respect those efforts from Major general Abdel Rahman Sirelkhatem, Mr. Kasim Elhiti, Mrs. Wafa, Ms. Sara, Mr. Abbas, Mr. Mubark, Mr. Babikir, Mr. Ahmmed, Mr. Eissa, Mr. Tahir, Mr. Kasimelsaeed, Mrs. Hadia, Ms. Nimat and Abdelazeem.

My thanks to all Laser Institute employees, my colleagues, Colonel engineer Tigani, Mr. Abdella Salih, Mr. Mutamn and all my friends.

I acknowledge gratefully the assistance given to me by Karary Academy of Technology.

Finally I would like specially to express my warm gratitude to my, mother, wife and children, for a wonderful understanding during this work.

DEDICATION

I dedicate this thesis to my mother, my wife and children, my sisters, brothers to souls of my father, and my brother Ali. Also to my relatives and colleagues friends and to Mohamed Brakat.

إهداء

إلـــــــى أمـــــــــــــــــــــــــــــي ،

زوجتـــــــــــــــــــــــــي ، أبنـــائي ،بنـــاتي ،

أخوانـــــــــــــي وأخواتـــــــــــي .

إلـــى روح أبـــــــــــــي وروح أخـــــــي

علـــي. إلـــى زملائـــــــي وأصدقائـــــــــــي

وأقربائـــــــــــي والى أخي محمد بركات.

CONTENTS

ABSTRACT

The system that has been designed and constructed combined of laser tracking system and video tracking system. The laser tracking system consists of laser source, optomechanical housing, electro-optic unit and interfacing unit. The laser beam was transmitted to a moving target and received by the optical receiver. The heart of the optical receiver is the quadratic detector, which is received the returned beam and converted to electrical signal and then to digital signal through an ADC and that shown as image of the target on the monitor.

In video tracking the CCD camera has been used, and the moving target detected. The performance of the system is evaluated by conducting several tests on computer and camera generated scenes for different target and background conditions.

The software used to determine the error function in the target position is a visual basic program.

There are many advantages of this system:
First, the system combined of laser tracking and video tracking; this gives cooperative performance with high efficiency. Second, the system used four ADC rather than one ADC with multiplexer so the system is fast. Third, The software program has the ability to process directly with the PC. RAM without returning to the drivers of the video card. This point is very important because the principle of the real time may be approached. Four, The calculation of the attenuation is analytical, rather than empirical in the other systems. Finally, the Cassegranian optomechanical housing has been

used in this system is better than Newtonian, Gregorian and Herschelian optomechanical housing.

LIST OF TABLES

LIST OF FIGURES