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التوثيق الالكتروني والميكرو فيلم

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التوثيق الالكتروني والميكروفيلم

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بالرسالة صفحات

لم ترد بالأصل



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Vision-Based Robot Bin Picking: Recognition and Localization Of Multiple Objects

By

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B. Sc. (Prod. Eng.), M. Sc. (Prod. Eng.)

A Ph. D Thesis

Submitted in Partial Fulfillment for the Degree of

Doctor of Philosophy

In Production Engineering

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

سُبْحَانَكَ يَا مَنْ عَلَّمَ لَنَا مَا عَلَّمْنَا

لَا نَشْكُرُكَ يَا مَنْ عَلَّمَ لَنَا مَا عَلَّمْنَا

صَدَقَ اللَّهُ الْعَلِيمُ

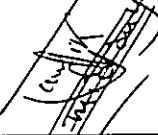
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Recognition and Localization of Multiple objects

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Dedication

*To My beloved Parents
For Their Unlimited Love, Care,
Sincerity, Great Support and Encouragement
God Bless Them Forever.*

*Ghada Elhendawy
2006*



Acknowledgements

It is a pleasure to express my deepest gratitude to my dear supervisors

Prof. Dr. Tawfik El-Midany

Prof. of Prod. Eng.

Asst. Prof. Ahmed A. Elkeran

Asst. Prof. of Prod. Eng.

*for their excellent supervision of this thesis. I would like to greatly
acknowledge their guidance, sincere help, assistance encouragement
and invaluable suggestion through the supervision of this thesis.
Finally, I deeply thank my supervisors, without their encouragement
and hardly support this thesis may have never been completed.*

*Ghada Elhendawy
2006*



ABSTRACT

Bin Picking is one of the most difficult tasks for a robot to perform specially for unorganized parts. Machine vision is a vital tool that enables robots to perform this important task. This thesis introduces two vision based systems which give a robot the ability to recognize and localize automatically unorganized parts from a pile. The object recognition technique in the first system is based on shape contour and region features. These derived features are invariant with respect to scaling, rotation, translation, and affine transformation of the objects. The extracted features are used for training both Self Organizing Map (SOM) and Multi Layer Perceptron (MLP) neural networks for classification purpose. The object recognition technique in the second system is based on the important object features. Important object features are obtained in two steps: firstly; by segmenting the object boundary at multiple scales through the use of its Iterative curvature scale space (ICSS) and secondly; by concentrating on each scale separately in order to search for groups of segments which distinguish an object from others. These groups of segments are; then, used to build a model database through the use of artificial neural networks (ANNs). The developed vision systems are implemented using Matlab software. The efficiency of the proposed

vision based systems is demonstrated through several examples so as to recognize parts and obtain satisfactory results.

The present thesis is divided into six chapters as follows:

Chapter one introduces the robot bin picking problem and the motivation beyond this work.

Chapter two illustrates the more relevant and related works to solve the robot bin picking problem and pattern recognition techniques with regard to literature review. Moreover, this chapter exposes the main aim of the research.

Chapter three presents in detail the proposed system for classification the separated objects. It, also, deals with the experiments and results of the proposed system.

Chapter four handles in detail the proposed system for recognizing the partially occluded objects with geometric transformations. Also, it deals with the experiments and results of the proposed system.

Chapter five handles the details of robot gripper descriptor.

Chapter six is a summing up of the finding of the research and the suggestions for the future work.

Nomenclature

CCD	Charge Coupled Device.
SOM	Self Organizing Map.
MLP	Multi Layer Perceptron.
BM	Binary Moment.
AIM	Affine Invariant Moment.
GM	Gray Moment.
GF	Geometric Features.
FDs	Fourier Descriptors.
x_i	represents the gray level at the pixels in the neighborhood region
$x_{[i]}$	the same stored in ascending order
$\bar{g}(r,c)$	The ordered statistic filter obtains the gray level at pixel (r, c) of the smooth image
ϕ_i	Hu moments of order i .
η_{pq}	the normalized central moment of order $(p+q)$
μ_{pq}	the central moment of order $(p+q)$.
f_{xy}	the gray levels of individual pixels, and equal 1 for binary image .
m_{pq}	Pixel moment of order $(p+q)$.
$\hat{m}_{pq}$	Modified pixel moment of order $(p+q)$.
I_i	Affine invariant moment of order i .
ψ	the rate change of tangential angle
s	the arc length
k	the curvature
$\gamma(x)$	analytical functions
ICSS	Iterative Curvature Scale Space.
PE	Processing Elements.

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