1985 IEEE INTERNATIONAL CONFERENCE ON

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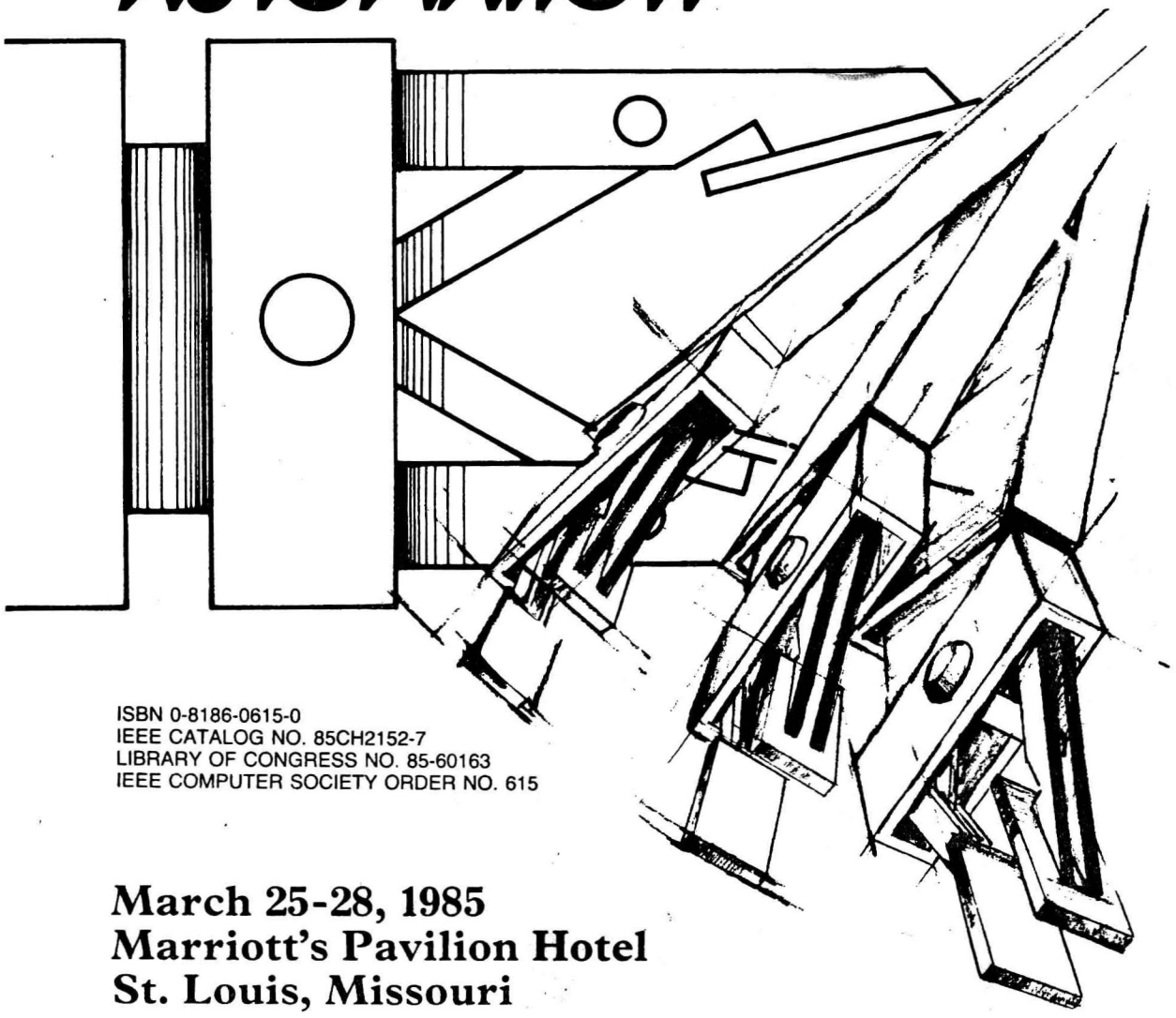

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Foreword

The "Proceedings of the 1985 IEEE International Conference on Robotics and Automation" presents a truly comprehensive picture of research in robotics and its application to automation. The enthusiastic response to our call for papers shows that this second in a series of conferences fills a longstanding need for a broad-based, research-oriented conference in robotics and advanced automation.

The depth of the papers included in this proceedings clearly indicates that robotics is rapidly maturing into an independent field with important results of its own. The variety of approaches in the papers also shows that robotics is a truly interdisciplinary area, where electrical and mechanical engineering, computer science, mathematics, and other disciplines must interact closely. The need for the interaction of many disciplines that are traditionally separate represents one of the greatest challenges, and potential rewards, of robotics research.

The diversity of backgrounds among researchers in robotics and automation has led to a bewildering variety of avenues for dissemination of research results. As a result, it is nearly impossible to keep track of research across the whole field. This problem is particularly severe for students and newcomers into the field. It is our hope that this series of conferences will help improve the technical communication between the different segments of the research community in robotics and automation. We hope that this conference will become a central forum for interaction among the various disciplines.

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*Not received in time for publication.

Session 1A
Three-Dimensional Machine Vision

A VISION SYSTEM WITH 3D CAPABILITIES

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ABSTRACT

The first results of a vision system which adds to a 2D image the depth information of certain points are presented. The goal of the system is to provide the control unit of a robot with an approximate 3D description of the industrial part to be manipulated or of the working area.
Depth information about the selected points of the scene is obtained by stereo vision. The determination of disparity is solved by changing the point of view of the TV camera employed by means of two oscillating mirrors which allow continuous tracking of the selected points.
A specialized image processor has been designed to deal with the tasks of selection of outstanding points of objects (vertices) and continuous tracking of these points between consecutive images when displacing the mirrors in order to obtain a short time of calculation as well as a low cost system. That way at the end of each sweep of the mirrors we get the information needed to solve triangulation from pairs of homologe points.
The time spent to get the three dimensional information of the scene is about one second, which corresponds to the time need to get enough intermediate images to guarantee the correct tracking of vertices.

INTRODUCTION

Nowadays there a lot of vision systems which give a rather good 3D information of the scene.[1]
There are different methods of acquiring the depth information but in general they can be classified into three main groups depending on the aspects involved: stereo disparity, structured light projections and range images. Some examples of the mentioned methods are: striped lighting [2,3,4], grid coding [5], relative range from occlusion cues [6,7,8], depth from texture [9,10,11], range from focusing [12,13], shape from shading or surface orientation from image brightness [14,15], stereo disparity [16,17,18], range from camera motion [19,20], range from three orthogonal views [21], etc.
Most of the three-dimensional vision systems for robotics which at the moment in a developement phase share two general characteristics: Powerful informatic requirements and / or a long calculation time. Now, these two reasons make the application of 3D systems in industrial environments quite difficult [22].
The system presented tries to face these drawbacks by giving up some other features, restricting disparity analysis to some selected points of the scene in order to get their height above the working plane. This information may be enough to carry out guidance of the robot for a lot of applications if there is a complete information of the object on the X-Y plane. The drastic reduction of points to be analysed has allowed the design of a specialized processor to solve in real time the correspondence problem between two consecutive images.

1.- SYSTEM DESCRIPTION

The system consists on the elements shown in Fig. 1. A TV. camera mounted with two mobile mirrors which allow it to change the point of view. A signal preprocessor obtains directly during scanning the contour of the object detected on the scene [23] and during a second phase locates the vertices.

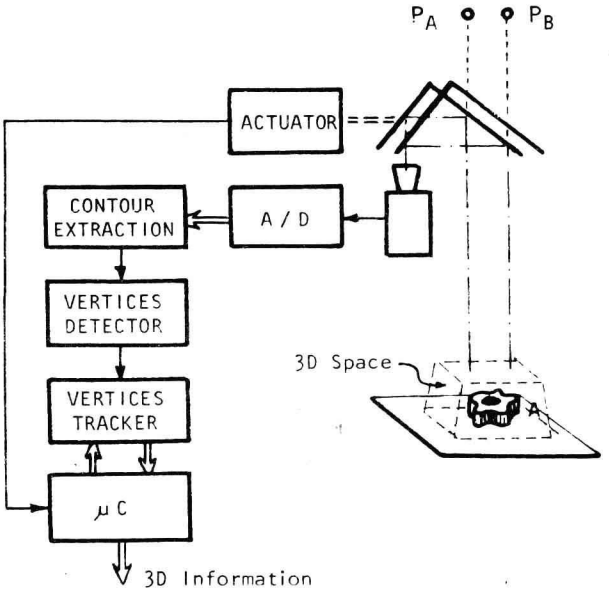

Fig. 1 System blocks diagram

A specialized processor deals with tracking tasks during the displacement of the point of view of the scene giving the needed data to a microcomputer at the end of each period. The microcomputer calculates triangulation for each point while the system is tracking vertices of the scene during the next period.

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