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A Robot Photographer with Human Interaction

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Abstract **— This paper describes a new robot-photographer system which can interact with humans. Our goal is to make the system act like a human photographer. The system is based on a mobile robot having capabilities of wireless communication and stereo vision. It recognizes waving hands of people, moves toward them, and takes pictures with great compositions. The pictures are transmitted to personal computers through wireless LAN.**

Keywords **— Robot Photographer, Face Detection, Caller Finding, ETRO, Human Robot Interaction**

1. Introduction

When a person is alone or a group of people want to be taken pictures, they need a photographer. In such situation, people usually use tripod or they usually call a person who can take pictures for them. This causes inconveniences. It will be very useful when there is a virtual photographer who can take pictures for them with well arranged and good compositions.

There is some previous work in the area of mobile robot photography from Washington University in St. Louis [1][2][3]. There is no interaction to take timely shots in Byers' robot photographer [1]. That robot serves as an event driven photographer, wandering around the same space as the participants, periodically taking photographs.

This robot can understand waving hands of people so when the robot recognizes that action then robot is working to get ready to take pictures. Also we use more robust algorithm for face detection. It serves us more elaborate performance.

There are some essential elements in the area of mobile robot photography. It includes basic robot tasks, like human-robot interaction, navigation and localization to avoid collision. Besides of those elements, robot photographer needs to know more about vision elements like exposure of light, optical focus, and framing. The first two conditions are automatically selected by our vision system. The only thing what we considered is image framing.

Mobile robot system is a complete device to deliver a camera. Like human being, robot can go back and forth, and also it can move its head to change viewable angle. To obtain good framed shots, we applied well-known photographic composition rules. Those are described in Section 4.

This robot operates with network mode. It does work alone but we applied CRIF to save computing power of a robot and to control the robot in remote place. CRIF stands for "Common Robot Interface Framework" which was developed by intelligent robot research division of ETRI. By using CRIF, robot acts like a client and the remote computer acts like a server. There is a URC server whose function is to provide information, calculate, and work behind for linked URC robots via network.

2. System Description

2.1 The Robot ETRO

The system is implemented on ETRO which stands for ETri RObot. ETRO is human-like robot for research. The full exterior and interior body shots are shown on Figure 1.

There are two independent computer systems in ETRO. The motor control board, ultra-sonic sensors and IR sensors are connected to lower computer using a Pentium-III 1Ghz processor, with 256MB of RAM. The lower computer communicates with control board and sensors by RS-232 serial communication protocols.

Cameras for robot vision, wireless LAN card for communicate with external server computer are attached to upper computer using a Pentium-IV 3Ghz processor, with 1GB of RAM. ETRO is equipped with two 410,000 pixels CCD cameras for stereo vision. This camera serves us 640 by 480 pixels images of max resolution. It is shown on Figure 2.

The upper computer uses Windows XP, but the lower computer uses Red Hat 7.3. The communication with two computers is worked by using TCP/IP socket protocols through LAN.

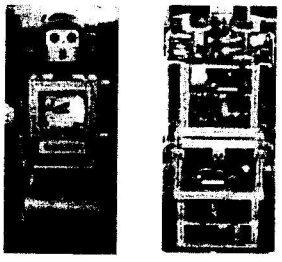

Figure 1. The robot ETRO