I-TA04 Man-Machine Systems 1

08:30-10:30 **Chair : Hashimoto Hideki (University of Tokyo)**
Room : C203 **Co-Chair : Chung W.K. (POSTECH)**

08:30 – 08:50 **I-TA04-1**

Mobile Robot Control for Human Following in Intelligent Space

Kazuyuki Morioka, Joo-Ho Lee, Zhimin Lin, Hideki Hashimoto
(Univ. of Tokyo)

Intelligent Space is a space where many sensors and intelligent devices are distributed. Mobile robots exist in this space as physical agents, which provide human with services. To realize this, human and mobile robots have to approach each other as much as possible. Moreover, it is necessary for them to perform interactions naturally. Thus, it is desirable for a mobile robot to carry out human-affnitive movement. In this research, a mobile robot is controlled by the Intelligent Space through its resources. The mobile robot is controlled to follow walking human as stably and precisly as possible.

08:50 – 09:10 **I-TA04-2**

Development of a Mobile Robot for Handicapped People

Shin IGAWA, Hyoung Seop KIM, Seiji ISHIKAWA (Kyushu Institute of Technology)

This paper describes a mobile robot intended for being employed in a multi-agent system. We have already proposed a multi-agent system which realizes patient-aid by helping a lying patient take a distant object on the table. In this paper, a mobile robot agent is developed and is included in the system. An effective man-machine communication strategy is proposed by use of a vision agent settled on the ceiling. If a human (assumed to be a patient) wishes to take an object distant on the floor, he points to the object. The vision agent detects the direction of his arm by image processing and guesses which object he intends to take. The vision agent asks him if it is what he wants and, if yes, the mobile robot runs to take and bring it to him. The system is overviewed with the explanation of a mobile robot. Some experimental results are shown with discussion.

09:10 – 09:30 **I-TA04-3**

Optimal Variable Damping Control for a Robot Carrying an Object with a Human

Ryojun Ikeura, Tomoki Moriguchi, Kazuki Mizutani
(Mie University)

This paper describes a control method of a robot cooperating with a human. A task in which a robot and a human move an object cooperatively is considered. To develop the force controller of the robot, the characteristics of human arm are investigated. The arm is forced to move along a trajectory in the experiment and the exerted force and the displacement are analyzed. It is found the force characteristics of the human arm is regarded as an optimal damper with minimizing a cost function. Then, the model is implemented to a robot and the cooperation of the robot and a human operator is examined. The effectiveness of the derived model is investigated and the experimental results show that the human moves the object supported by the robot with a minimum jerk trajectory.

09:30 – 09:50 **I-TA04-4**

A Five Degree-of-freedom Pen-based Cable-suspended Haptic Interface

Kyihwan Park, Tie Yun, and Byunghoon Bae
(KJIST)

In this paper, a five degree-of-freedom haptic device is proposed. The proposed haptic device has a pen which is suspended by tensioned six strings. Human operator handles the pen. Six DC motors are used as actuators to generate tensions in six strings to make resultant force feedback at the pen to the human operator. Six encoders are used for calculating the movement of the pen. A digital controller is used for generate control signals for the suitable tension in the six strings. A current amplifiers is used for amplifying the control signals. Cable-suspended system has advantages of structure simplicity (only with several strings driven by motors without using other tensioning mechanisms), low inertia, and high force-to-weight ratio. Pen-based system has advantages of compactness and ...

09:50 – 10:10 **I-TA04-5**

On the Design Method of a Haptic Interface Controller with Virtual Coupling

Keehoon Kim W. K. Chung Y. Youm
(Pohang University of Science and Technology)

A haptic interface can be a passive system with virtual coupling as a filter. Virtual coupling has been designed for satisfying passivity. However, it affects transparency of haptic interface as well as stability. This paper suggests new design criterion of a haptic interface controller by considering transparency. As a result, sampling time and the range of impedance or admittance should be considered as well as virtual coupling for desired performance of haptic display. And experiments show that the suggested design criterion can be applied successfully for desired performance.

10:10 – 10:30 **I-TA04-6**

Multi-Camera Vision System for Tele-Robotics

Changhwn Choi, Kohtaro Ohba, Kyihwan Park, Sayaka Odano, Hisayaki sasaki, Nakyoung Chong, Tetsuo Kotoku and Kazuo Tanie
(K-JIST)

A new monitoring system is proposed to give direct visual information of the remote site when working with a tele-operation system. In order to have a similar behavior of a human when he is inspecting an object, multiple cameras that have different view point are attached around the robot hand and are switched on and off according to the operator's motion such as joystick manipulation or operator's head movement. The performance of the system is estimated by performing comparison experiments among single camera (SC) vision system, head mount display (HMD) system and proposed multiple camera (MC) vision system by applying a task to several examinees. The reality, depth feeling and controllability are estimated for the examinees ...