Sense Feedback Control of Anthropomorphic Robot For Medical and Welfare Support

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**Project Purpose**
Intelligent sense feedback control systems has been researched using various human sensor such as brain wave, cardiac rate, blood flow, human-skin electric resistance, vision, haptic, position and force sensor in COE project.

**Project Contents**
- Anthropomorphic Multi-fingered Robot Hand.
- Comfort and Safety Motion of Robot Arm using Human Sense Information.
- Master and Slave Arm Control with Human Sensor for Rehabilitation by Tele-operation.
- Omni-directional Mobile Wheelchair (OMW) with Considering Patient’s Comfort.

**Project Scenario of Final Goal**

**Project Present Work**

(I) Multi-fingered Robot Hand
- Control of Various Human Finger Motion by Robot Hand
  - Grasping, Re-grasping, Manipulation, Massage motion
- Expert Massage Robot
  - Measurement of finger-tip force and position
  - Reproduction of expert massage by robot
  - Memory in Computer

(II) Comfort and Safety Motion of Robot Arm using Human Sense Information
- Study on comfort and safety motion of robot arm
  - Object Evaluation: Brain wave, Cardiac rate
  - Subject Evaluation: SD test (Semantic Differential)

(III) Rehabilitation System by Tele-control with Human Sensor
- (1) Tracking control of Master and Slave Arm with haptic feedback for rehabilitation
- (2) Real-Time Optimum motion control for rehabilitation by using human sensor such as EMG signal to adjust each person and daily condition

(IV) Omni-directional Mobile Wheelchair
- (1) Developed OMW has three modes:
  - Full-Auto, Semi-Auto, Power-Assist
- (2) Semi-Auto Case:
  - Impedance control of joystick
    - Ultrasonic sensor and PSD (infrared sensor)
    - Harmony of human and machine
- (3) Power-Assist Case:
  - Operation by Helper
    - Measurement by torque sensor
    - Estimation of moving direction by Fuzzy Reasoning
    - Comfort driving by power assist

Fig. 5 Experimental devices for investigating comfort and safety motion of robot arm

Future Plans
(1) To establish advanced control systems of anthropomorphic robot with multi-fingered hand, realizing the complex motion such as human manipulates.
(2) To complete the intelligent control of anthropomorphic robot, comprised of arm and hand for the change of environments, by using high-speed vision chip of 1 [ms] and various human sensors.
(3) To develop tele-operation rehabilitation robot systems by using human sensor and haptic feedback.
(4) To exploit omni-directional mobile wheelchair with comfort and safety by using various human sensors, for supporting the disabled people.