HUMAN ROBOT MOTIONS WITH FINGERS BY USING MEMS

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Abstract: In this paper, adaptive impedance control is proposed for a robot collaborating with a human partner, in the presence of unknown motion intention of the human partner and unknown robot dynamics. Human motion intention is defined as the desired trajectory in the limb model of the human partner, which is extremely difficult to obtain considering the nonlinear and time varying property of the limb model. Neural networks are employed to cope with this problem, based on which an online estimation method is developed. The estimated motion intention is integrated into the developed adaptive impedance control, which makes the robot follow a given target impedance model. Under the proposed method, the robot is able to actively collaborate with its human partner, which is verified through experiment studies.

Index Terms—Human–robot collaboration, motion intention estimation, neural networks (NNs).

I. Introduction

The main purpose of this project to design a hand-glove robot which is controlled according to the movement of fingers of hand. The existing model is as follows. Robot is very useful for mankind in doing uncertain tasks and there are different way of approaches to control the robot like voice or wireless communications but none of them will be useful in providing friendly environment for disabled person so we propose a system in which robot can be operated through gesture. The developed model is as follows. In proposed system accelerometer sensor is attached to the user hand or head depending upon the hand gestures or head movements the robot will be controlled the robot is provided with arm structure which can be helpful in picking the things.

II. Hardware system

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (LCD) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits,
and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

III. Board hardware resources features

MEMS:
Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through microfabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar, or BICMOS processes), the micromechanical components are fabricated using compatible "micromachining" processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical devices. Microelectromechanical systems (MEMS) (also written as micro-electro-mechanical, or MicroElectroMechanical) is the technology of the very small, and merges at the nano-scale into nanoelectromechanical systems (NEMS) and nanotechnology. MEMS are also referred to as micromachines (in Japan), or Micro Systems Technology - MST (in Europe). MEMS are separate and distinct from the hypothetical vision of molecular nanotechnology or molecular electronics. MEMS are made up of components between 1 to 100 micrometres in size (i.e. 0.001 to 0.1 mm) and MEMS devices generally range in size from 20 micrometres (20 millionths of a metre) to a millimetre. They usually consist of a central unit that processes data, the microprocessor and several components that interact with the outside such as microsensors. At these size scales, the standard constructs of classical physics are not always useful. Due to MEMS' large surface area to volume ratio, surface effects such as electrostatics and wetting dominate volume effects such as inertia or thermal mass. MEMS technology can be implemented using a number of different materials and manufacturing
techniques; the choice of which will depend on the device being created and the market sector in which it has to operate.

**MEMS ACCELEROMETER:** Accelerometers are acceleration sensors. An inertial mass suspended by springs is acted upon by acceleration forces that cause the mass to be deflected from its initial position. This deflection is converted to an electrical signal, which appears at the sensor output. The application of MEMS technology to accelerometers is a relatively new development. This device works with the capacitance and the changes initiated within it as a result of some accelerative force. This technology is used from automotive industry to agriculture industry and from NASA to military researches and operations.

**DC Motor Driver:** The L293 is an integrated circuit motor driver that can be used for simultaneous, bi-directional control of two small motors. Small means small. The L293 is limited to 600 mA, but in reality can only handle much small currents unless you have done some serious heat sinking to keep the case temperature down. Unsure about whether the L293 will work with your motor? Hook up the circuit and run your motor while keeping your finger on the chip. If it gets too hot to touch, you can’t use it with your motor. (Note to ME2011 students: The L293 should be OK for your small motor but is not OK for your gear motor.) The L293 comes in a standard 16-pin, dual-in line integrated circuit package. There is an L293 and an L293D part number. Pick the "D" version because it has built in flyback diodes to minimize inductive voltage spikes.

The pinout for the L293 in the 16-pin package is shown below in top view. Pin 1 is at the top left when the notch in the package faces up. Note that the names for pin functions may be slightly different.

![Driver circuit](image)

**DC Geared Motor:**

High efficiency, high quality low cost DC motor with gearbox for robotics applications. Very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel.

**Features**

- 45 RPM 12V DC motors with Gearbox
- 5kgcm torque
- 3000RPM base motor
- 6mm shaft diameter with internal hole
- 125gm weight
- Same size motor available in various rpm
- No-load current = 60 mA(Max), Load current = 300 mA(Max)

![DC geared motor](image)

**IV. CONCLUSION**

In this paper, human–robot collaboration has been investigated, in which the motion intention of the
human partner has been observed by employing the human limb model and estimating the desired trajectory. An NN method has been proposed to cope with the problem of an unknown human limb model. The estimated motion intention has been integrated into impedance control of the robot arm, such that it actively follows its human Partner. Experiment results have been provided to verify the validity of the proposed method.

V. REFERENCES


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