HUMAN COLLABORATIVE WORK FOR GESTURE BASED ASSISTIVE ROBOT WITH THIRD EYE

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Abstract: Myoelectric controlled interfaces have become a research interest for use in advanced prostheses, exoskeletons and robot teleoperation. Current research focuses on improving a user's initial performance, either by training a decoding function for a specific user or implementing "intuitive" mapping functions as decoders. This paper proposes a paradigm shift on myoelectric interfaces by embedding the human as controller of the system to be operated. Using abstract mapping functions between myoelectric activity and control actions for a task, this study shows that human subjects are able to control an artificial system with increasing efficiency by just learning how to control it. A chronological evaluation across trials reveals that the learning curves transfer across subsequent trials having the same mapping, independent of the tasks to be executed. This implies that new muscle synergies are developed and refined relative to the mapping used by the control task, suggesting that maximal performance may be achieved by learning a constant, arbitrary mapping function rather than dynamic subject- or task-specific functions. In this project we have used touch screen panel which increases accessibility along with gesture movements we can control a robot using patterns on touch screen.

Key words:Mems, Zigbee, Rfid, Motors, Ethernet, Pc, Touch screen

INTRODUCTION

The main challenge in myoelectric controlled interfaces lies in decoding human provided signals to commands capable of operating the desired application. Many decoding algorithms have been developed using machine learning techniques, but these currently suffer from subject specificity and require intense training phases before any real-time application is feasible. A few other approaches have implemented simple decoders meant to be intuitive for users to control simple commands. Thus, these approaches do not necessarily provide a foundation for maximal performance over time. Before presenting the novelty of the proposed technique, it is useful to give the definitions of two concepts that will be frequently used in the paper.

1) Control task: task to be executed by the subject using the myoelectric interface and touch screen instruction, implying both the *device* to be controlled (e.g., a robot hand) as well as its possible *functions*.

2) Mapping function: mathematical function that maps myoelectric activity to control actions for the task, e.g., a function that will translate myoelectric signals to opening the fingers of a robot hand.

This paper proposes a paradigm shift on myoelectric control interfaces that extends beyond using trainable decoders, by suggesting arbitrary mapping functions between the neural activity and the control actions. More specifically, this paper investigates user performance with myoelectric interfaces and touch screen instructions which were neither designed for the subject nor the task.

The 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.

ARM7TDMI: 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.

Design of Proposed Hardware System

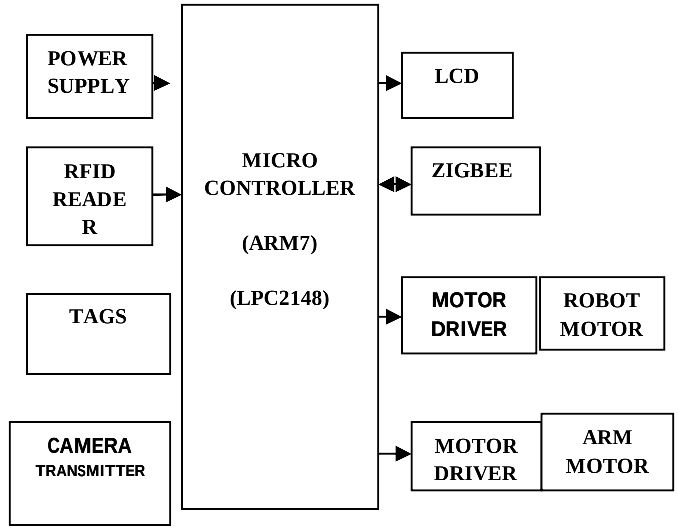

Fig.1.Block diagram

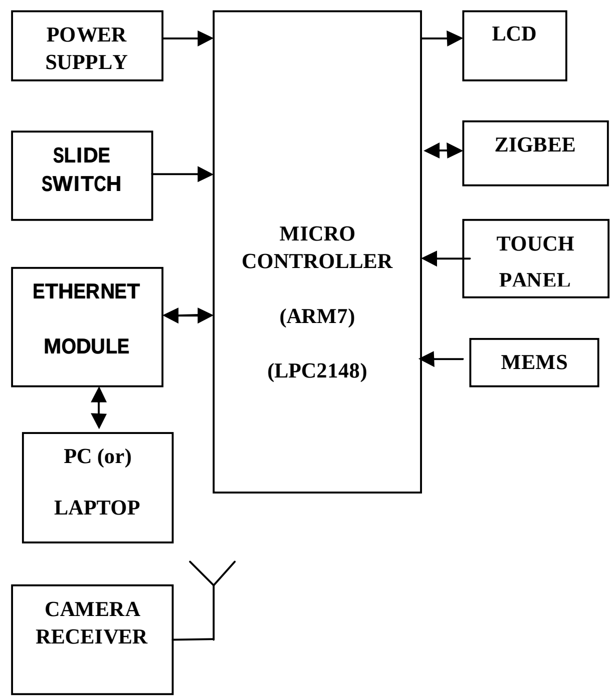

Fig.2.Block diagram

In this project we have two sections which are:

1) Communication Section :

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It consists of microcontroller, zigbee module, MEMS, Ethernet, PC, Camera receiver, LCD display, power supply. Here instruction to a human controlled robot is given either using mems or touch panel patterns. Tis information is send to robot section through Zigbee . the informations like camera photage, rfid reader location are collected in this section and this can be viewed in pc.

2) Robot Section:

This section consists of rfid reader to read rfid card at sections, zigbee transceiver, motor driver and motors to move as per instructions, camera trtansmitter to transmit images of surroundings. This section can move according to the instructions given using mems or touch panel in communication section.

Board Hardware Resources Features

Ethernet

Networking is playing vital role in current IT era where data distribution and access is critically important. As the use of communication between two or more entities increases the networking technologies need to be improved and refurbished over time. Similarly the transmission media, the heart of a network, has been changed with the time improving on the previous one. If you know a little bit about networking you surely have heard the term Ethernet which is currently the dominant network technology. Wide spread of the Ethernet technology made most of the offices, universities and buildings use the technology for establishment of local area networks (LANs).

To understand what actually Ethernet is, we need to know about IEEE first which is a short of Institute of Electrical and Electronics Engineers. IEEE is a part of International Organization for Standardization (ISO) whose standard IEEE 802.3 is defined for Local Area Network. The standard 802.3 commonly known as ETHERNT defines the communication standards for how data is transferred from one network device to another in a local area network. Since the limit for Ethernet cable is few hundred meters Ethernet is commonly deployed for networks lying in a single building to connect devices with close proximity. The same standard for Ethernet enables manufactures from around the earth to manufacture Ethernet products in accordance with the ISO standards that are feasible for all computing devices worldwide.

Zigbee

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this ase is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The below table gives the pin description of transceiver. The X-Bee RF Modules interface to a host device through a logic-level asynchronous Serial port. Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device.

Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

PC

Keyboards on an OEM basis to leading global PC manufacturers for use in desktop and notebook PCs and also supplies for retail keyboard OEMs.

Features:

- Internal Sourcing of almost all of main Parts

Almost all components - frame, key switches and membrane sheet - other than connecters and cord are manufactured in-house, giving Minebea an un-matched advantage in terms of quality, supply capabilities, cost-competitiveness and speed of delivery.

Especially, these products capitalize on Minebea's ultra-precision machining technology of components.

- Efficient Production System

Plant in China which supplies the global market employs the Minebea's vertically integrated manufacturing system, whereby all process, from machining components to final assembly are conducted in-house.

Rfid:

Many types of RFID exist, but at the highest level, we can divide RFID devices into two classes:active and passive.

Active Tag Passive Tag

Active tags require a power source i.e., they are either connected to a powered infrastructure or use energy stored in an integrated battery. In the latter case, a tag's lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo. However, batteries make the cost, size, and lifetime of active tags impractical for the retail trade.

Passive RFID is of interest because the tags don't require batteries or maintenance. The tags also have an indefinite operational life and are small enough to fit into a practical adhesive label. A passive tag consists of three parts: an antenna, a semiconductor chip attached to the antenna and some form of encapsulation. The tag reader is responsible for powering and communicating with a tag. The tag antenna captures energy and transfers the tag's ID (the tag's chip coordinates this process). The encapsulation maintains the tag's integrity and protects the antenna and chip from environmental conditions or reagents.

Mems

Micro electro mechanical systems (MEMS) are small integrated devices or systems that combine electrical and mechanical components. Their size range from the sub micrometer (or sub micron) level to the millimeter level and there can be any number, from a few to millions, in a particular system. MEMS extend the fabrication techniques developed for the integrated circuit industry to add mechanical elements such as beams, gears, diaphragms, and springs to devices.Examples of MEMS device applications include inkjet-printer cartridges, accelerometers, miniature robots, microengines, locks, inertial sensors, micro transmissions, micromirrors, micro actuators, optical scanners, fluid pumps, transducers and chemical, pressure and flow sensors. Many new applications are emerging as the existing technology is applied to the miniaturization and integration of conventional devices.

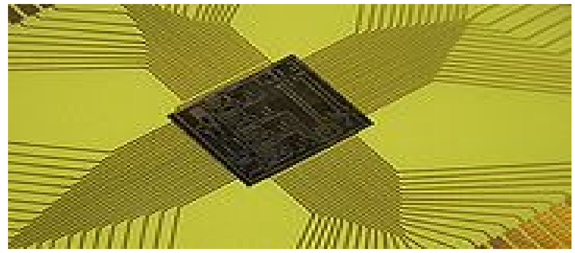

Fig: MEMS chip

These systems can sense, control and activate mechanical processes on the micro scale and function individually or in arrays to generate effects on the macro scale. The micro fabrication technology enables fabrication of large arrays of devices, which individually perform simple tasks, but in combination can accomplish complicated functions.

MEMS are not about any one application or device, or they are not defined by a single fabrication process or limited to a few materials. They are a fabrication approach that conveys the advantages of miniaturization, multiple components and microelectronics to the design and construction of integrated electromechanical systems. MEMS are not only about miniaturization of mechanical systems but they are also a new pattern for designing mechanical devices and systems.

Wireless AV camera.

Tiny size for discreet observation and portability Built-in microphone for audio monitoring 4 channels optional to avoid possible interference camera (Effective range:3m) Up to 100m (330ft.)

transmission range in open space

Fig: Camera Transmitter and Reciever

CONCLUSION

The contribution of this paper is twofold: 1) it provides evidence that a user-specific decoder is not required, as long as the subject can learn a mapping function between the gestures and the task commands and 2) it demonstrates that subjects do not only learn those mappings between their actions and the control task, but they can retain this ability and generalize it to different control tasks. These two findings support the idea of the human embedded control of devices. More specifically, we have shown that humans can be trained to control different tasks by using their muscular activity directly to the control axes of the tasks (i.e., embedded control). The implications of this method are vast, since it means that humans are able to control any device, without the latter being anthropomorphic or resembling any of the human counterparts. Instead of training decoders for specific humans, humans can be trained for specific decoders, which may then generalize to a myriad of myoelectric interfaces. Tackling these problems of user specificity and extensive decoder training that cannot generalize to new tasks opens new avenues and capabilities for the intelligent control of robots using gesture position or instructions given on touch screen.

REFERENCES

[1] A. de Rugy, G. E. Loeb, and T. J. Carroll, “Muscle coordination is habitual rather than optimal,” *J. Neurosci.*, vol. 32, no. 21, pp. 7384 7391, May 2012.

[2] D. Graupe and K.W. Cline, “Functional separation of EMG signals via ARMA identification methods for prosthesis control purposes,” *IEEE Trans. Syst.,Man Cybern.*, vol. SMC-5, no. 2, pp. 252–259,Mar. 1975.

[3] D. Nishikawa, W. Yu, H. Yokoi, and Y. Kakazu, “EMG prosthetic hand controller using real-time learning method,” in *Proc. IEEE Int. Conf.Syst., Man, Cybern.*, 1999, vol. 1, pp. 153–158.

[4] M. V. Liarokapis, P. K. Artemiadis, P. T. Katsiaris, K. J. Kyriakopoulos, and E. S. Manolakos, “Learning human reach-to-grasp strategies: Towards EMG-based control of robotic arm-hand systems,” in *Proc. IEEE Int. Conf. Robot. Automat. (ICRA)*, May 2012, pp. 2287–2292.

[5] P. K. Artemiadis and K. J. Kyriakopoulos, “An EMG-based robot control scheme robust to time-varying EMG signal features,” *IEEE Trans. Inform.*

Technol. Biomedicine, vol. 14, no. 3, pp. 582–588, May 2010.

[6] A. B. Ajiboye and R. F.Weir, “Muscle synergies as a predictive framework for the EMG patterns of new hand postures,” *J. Neural Eng.*, vol. 6, no. 3, p. 036004, Jun. 2009.

[7] F. E. Zajac, “Muscle and tendon: Properties, models, scaling, and application to biomechanics and motor control,” *Stanford Univ.*, vol. 17, p. 52, 1989.

[8] R. Héliot, K. Ganguly, J. Jimenez, and J. M. Carmena, “Learning in closed-loop brain-machine interfaces: Modeling and experimental validation,” *IEEE Trans. Syst., Man, Cybern.*, vol. 40, p. 11, 2010.

[9] G. J. Gage, K. A. Ludwig, K. J. Otto, E. L. Ionides, and D. R. Kipke, “Naive coadaptive cortical control,” *J. Neural Eng.*, vol. 1, p. 13, 2005.

[10] [Online]. Available: http://www.opengl.org

[11] U. Sahin and F. Sahin, “Pattern recognition with surface EMG signal based wavelet transformation,” in *Proc. IEEE Syst., Man, Cybern. Conf. (SMC)*, pp. 295–300.

[12] G. Naik, D. Kumar, and Jayadeva, “Twin SVM for gesture classification using the surface electromyogram,” *IEEE Trans. Inform. Technol. Biomedicine*, vol. 14, no. 2, pp. 301–308, Mar. 2010.

[13] P. K. Artemiadis, P. T. Katsiaris, and K. J. Kyriakopoulos, “A biomimetic approach to inverse kinematics for a redundant robot arm,” *Autonomous Robots*, vol. 29, no. 3-4, pp. 293–308, Nov. 2010.

[14] F. Orabona, C. Castellini, B. Caputo, A. Fiorilla, and G. Sandini,“Model adaptation with least-squares SVM for adaptive hand prosthetics,”in *Proc. IEEE Int. Conf. Robot. Automat.*, May 2009, pp. 2897–2903.

[15] C. Cipriani, F. Zaccone, S. Micera, and M. Carrozza, “On the sharedcontrol of an EMG controlled prosthetic hand: Analysis of user-prosthesis interaction,” *IEEE Trans. Robot.*, vol. 24, no. 1, pp. 170–184, Feb. 2008.

[16] P. Nilas, P. Rani, and N. Sarkar, “An innovative high-level humanrobot interaction for disabled persons,” in *Proc. IEEE Int. Conf. Robot. Automat. ICRA ’04*, Apr.-May 1, 2004, vol. 3, pp. 2309–2314.

[17] F. A. Mussa-Ivaldi, M. Casadio, Z. C. Danziger, K. M. Mosier, an R. A. Scheidt, “Sensory motor remapping of space in human-machine interfaces,” *Progr. Brain Res.*, vol. 191, p. 45, 2011.

[18] K. M. Mosier, R. A. Scheidt, S. Acosta, and F. A. Mussa-Ivaldi, “Remapping hand movements in a novel geometrical environment,” *J. Neurophysiol.*, vol. 94, no. 6, pp. 4362–4372, Dec. 2005.

[19] J. P. Cunningham, P. Nuyujukian, V. Gilja, C. A. Chestek, S. I. Ryu, and K. V. Shenoy, “A closed-loop human simulator for investigating the role of feedback control in brain-machine interfaces,” *J. Neurophysiol.*, vol. 105, no. 4, pp. 1932–1949, Apr. 2011.

[20] D. M. Taylor, S. I. H. Tillery, and A. B. Schwartz, "Direct cortical control of 3D neuroprosthetic devices," *Science*, vol. 296, pp. 1829–1832, 2002.

[21] K. Nazarpour, A. Barnard, and A. Jackson, "Flexible cortical control of task-specific muscle synergies," *J. Neurosci.*, vol. 32, no. 36, pp. 12 349–12 360, Sep. 2012.

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