INTERNATIONAL JOURNAL OF EMINENT ENGINEERING TECHNOLOGIES

Volume 5, Issue 1 SEP 2017

EFFECTUAL USER DIRECTION OF ROBOTS USING MYOELECTRIC INTERFACES

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Abstract:

Myoelectric controlled interfaces are a vital component for advancing pplications in prostheses, exoskeletons, and robot teleoperation. Current methods search for optimal neural decoders for enhanced Initial user performance. How-ever, recent studies demonstrate learning an inverse model of abstract decoders to improve performance over time. This paper proposes a paradigm shift on myoelectric interfaces by embedding the human as controller of a system and allowing the human to learn how to control it via control tasks with similar mapping functions. The method is tested using two different control tasks and four different abstract mappings of upper limb myoelectric signals to control actions for those tasks. The results confirm that all subjects are able to learn themappings and improve performance efficiency over time. A cross-trial evaluation reveals a significant learning transfer when a new control task is presented using the same mapping as a previous task, resulting in enhanced initial performance with the new task. Comparison of EMG signal evolution across subjects indicates a significant population-wide muscle synergy development that results from learning and implementing the inverse model of the mapping function to complete the tasks. This suggests that efficient performance may be achieved by learning a constant, arbitrary mapping function applied to multiple control tasks rather than dynamic subject-or task-specific functions. Moreover, this method can be used for the neural control of any device or robot, without restricting them to anthropomorphic or human-related counterparts.

Key words: *Mems, Zigbee, Rfid, Motors,Ethernet,pc.*

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. useful to give the definitions

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.

S3C2440A:

S3C2440A is a 16/32-bit RISC microprocessor. SAMSUNG's S3C2440A is designed to provide hand-held devices and general applications with low-power, and high-performance microcontroller solution in small die size. To reduce total system cost, the S3C2440A includes the following components. The S3C2440A is developed with ARM920T core, 0.13um CMOS standard cells and a memory complier. Its low power, simple, elegant and fully static design is particularly suitable for cost- and power-sensitive applications. It adopts a new bus architecture known as Advanced Micro controller Bus Architecture (AMBA). The S3C2440A offers outstanding features with its CPU core, a 16/32-bit ARM920T RISC processor designed by Advanced RISC Machines, Ltd.

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.

I. Design of Proposed Hardware System

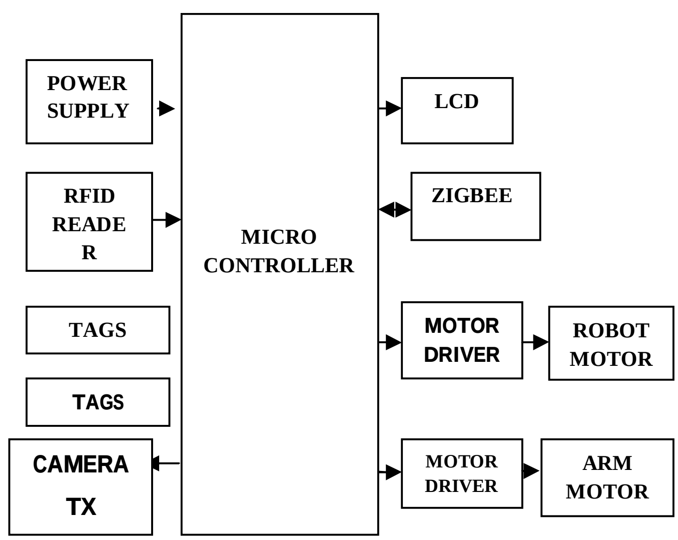

Fig.1.Robotic Section Block diagram

With the advancement of technology, we can overcome above drawbacks we are going this proposed method. In this method we are going to maintain a library using my controller based system. Here in this system we will be using touch panel to operate my robot section like move front, back, left, right and placing wireless camera on the robot section. It will capture the images of books in shelf and send data to receiver section. Then we can monitor the captured images using software and we will be using here MEMS technology to pick and place the objects like books and we are maintain the information in memory. They maintain records for giving books and taking books from the users. This leads time consuming, wastage paper books and also maintaining of more workers that means cost is increased. These are the drawbacks of above system.

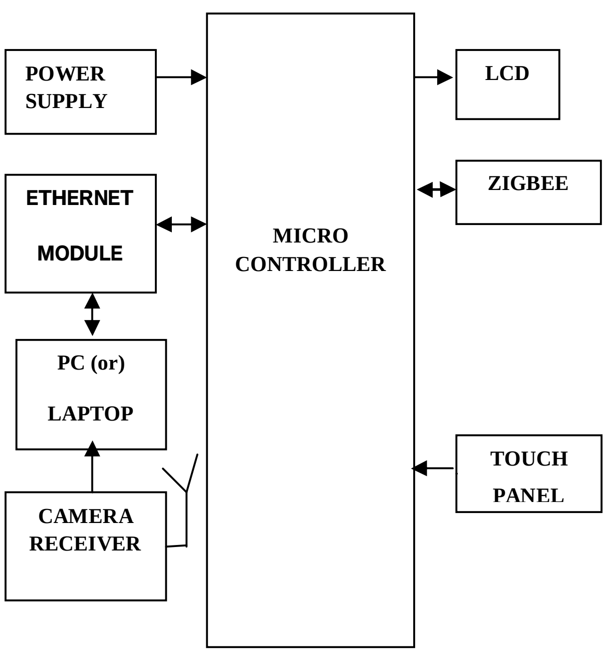

Fig.2. Monitoring Section Block Diagram

II. 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).

Fig:3:LAN

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 O

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 supplys 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.

Fig:4:RFID tags

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.

III. CONCLUSION

This paper investigates the role of mapping functions in myoelectric controlled interfaces. It is shown that subjects are not only able to learn the inverse model of arbitrary mapping functions, but more importantly are capable of generalizing this model to enhance performance on new control tasks containing similar mapping functions. Performance is determined to be more dependent on familiarity with a given mapping function than familiarity with a given control task, indicating that subjects can learn new control tasks so long as they know how to explore the task space.This control is robust to variability caused by small changes in sensor placement that occurred while performing the experiment over multiple days. These findings imply that subjects are able to develop and re fine muscle synergies for a given mapping function which enables them to explore the task space more efficiently. As mentioned in , the synergy development is enhanced by the choice of two pairs of antagonistic muscles, with each pair biomechanically independent. Including biomechanically dependent muscles, such as in, would likely hinder a subject's ability to learn these synergies due to low level mechanical restraints. The study also reveals that the specific choice of mapping function may not be as relevant as previously emphasized in the literature. Even though mapping appears to be the most intuitive for a majority of the subjects, the best overall performance occurs using the randomly generated mapping, and end performance for all mapping functions is more similar than the large discrepancies in initial performance. This is consistent with previous findings using closed loop feedback to learn inverse models of mapping functions, and another indicator of muscle synergy development to allow more efficient performance. Thus, we have proposed a myoelectric controlled interface which is not subject-specific and we also show that learning of a mapping for a particular task can still be transferred to new tasks.

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