A Perspective to the Embedded Systems and Robotics Laboratory Tezpur University

This article introduces the Embedded Systems and Robotics Laboratory (ERL) in the department of ECE, School of Engineering, Tezpur University. This laboratory was started in November 2012 with a research focus to contribute to the domain of rehabilitation robotics i.e., robotics to support differently abled people. ERL strives for making education to be society driven project-based learning and plans to practice the technical expertise using the concepts of everything-as-a-service for entrepreneurship in the space of health care. Two of the current activities involve development of a prosthetic hand for people who have lost their hand in a catastrophic incident.

Mr. Amlan J. Kalita, PhD scholar in ERL, is working on development of a prosthetic hand for transradial and transhumeral amputees. Although use of prostheses has been started around 500 years back, the application of robotics concept for improving human satisfaction draw attention in late 20th century. His study focuses on development of an electromyogram (EMG) CoNtrolled PRosthetIC Hand, called ENRICH. EMG is the electrical manifestation of muscle activity that can represent the intention of human for performing tasks by hand. This study aims at iterative design and development of ENRICH based on feedback from academic and clinical testing. A computer aided design of ENRICH was created by mimicking the human hand. Figure 1 (A) and (B) shows CAD and developed prosthetic hand prototype. ENRICH is controlled using the electromyogram i. e. muscle signals from the trapezius muscle. Figure 1 (C) shows the initial clinical trial. This is followed by pilot testing of ENRICH with two known users for their daily living activities as in Figure 1 (D) and (E).

Figure 1: (A) CAD of ENRICH (B) ENRICH prototype (C) Clinical Testing of ENRICH (D) Pilot Testing in Manipur (E) Pilot Testing in Tezpur

In another attempt aiming for an advanced prosthetic hand by Ms. Maibam Pooya Chanu, PhD scholar in ERL, is working on development of a prosthetic hand based on brain computer interface (BCI). Figure 2 shows a schematic of BCI-based prosthetic hand.

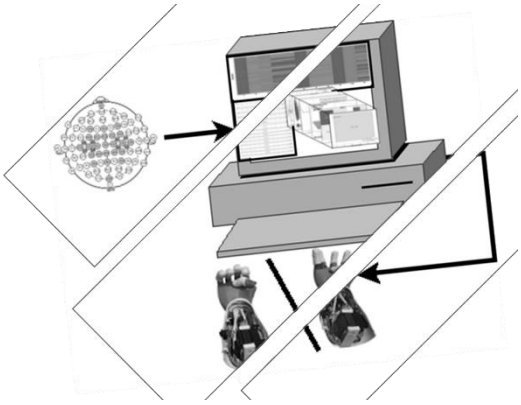

Figure 2: BCI-based prosthetic hand

Assume that you intended to hold your loved one's hand, but your partner figured it out even though you were unable to express it. This kind of scenario will transform into the real world in near future with the advances in BCI technologies. As the twenty-first century hits its third decade, the human race is yearning for a new technological breakthrough that will spotlight the advancement of the brain beyond academic research. To make the significant breakthrough, this amazing complex human machine performing dextrous hand movement effortlessly entails to think critically, study genuine challenges and gradually enhance the understanding of human motor control.

Emphasizing the contribution to the service for the individuals with limb amputations in India who face challenges in their social and professional lives, this research aims to address the challenges with an indigenously developed prosthetic hand. Currently, this research is focusing on computational modelling of the cerebellum for generation and the basal ganglia for synergy selection in order to control a high degree of freedom of a prosthetic hand. This holds potential to transform the hope of every individual with limb amputation by enabling near-natural functionality.

Nayan M Kakoty
Professor, ECE department
Tezpur University