A Real Time Mobil Robot Control Using Bio-Signals of the Human Forearm

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Extended Abstract

Robotics is the field of electro-mechanical devices and machines that are able to perform repetitive or dangerous tasks, in place of human beings either for safety reasons or to improve productivity. One application of robots is an unmanned military robot, which is developed to protect warfighters and first responders against explosive threats. These robots can be controlled by remote controllers. However, the observability of robot surroundings is reduced due to the primary focus of the operator with the remote control device. If the remote controller was designed as a wearable device, the user may have better awareness of the robot's environment. For this project, we designed and used a wearable device which is placed on the forearm, and takes bio-signals (Electromyography) from the muscles in the arm as a controller.

Electromyography (EMG) signals obtained from electrodes on the forearm have several applications in several fields, such as clinical biomedical studies, health processes, and the development of human-robot interaction interface devices. Thalmic's "MYO Armband" is an example of these kind of devices with capacity to use for controlling applications in mobiles and computers. While other devices exist for collecting EMG signals, these devices are frequently complex using preprocessing techniques such as amplifying, filtering, and feature extracting. The MYO armband has a simplistic user-friendly embedded system consisting of eight electromyography (EMG) sensors for collecting bio-electric signals from different parts of the forearm muscle. It also has a three-axis gyroscope and a three-axis accelerometer. In addition, the MYO armband has other advantages compared with other EMG sensors, such as wireless communication and adaptation for variation of anthropometry.

In this work, we proposed the control system of mobile robotics via a wearable MYO armband with a fast and simple algorithm, called finite state machine for hand gesture classification using EMG signals. For real time control system, Raspberry Pi is used as a micro controller, providing Bluetooth communication between the mobile robot and MYO armband. There are three steps for control system. The first step of control, reads the EMG signals from the MYO armband attached to the forearm. The following step, classifies the five functions (move forward, backward, left, right, and stop) of the mobile robot to the five gestures measured by the MYO armband. The gestures are fist, spread, wave left, wave right and double tap. The final step involves the control of the dc motors, which are used to control movement of the mobile robot. Control signals are sent from microcontroller to motors depending on user's hand motions. Motors are controlled by Me Orion control board. To change the direction of the motors, appropriate logic levels (high/low) are applied to direction control pins of the board. As a result, the movement of the mobile robot has been successfully controlled according to the user's hand motions. We will describe the design and operation of this device and discuss applications.