Design and Development of EMG Controlled Prosthetics Lower Limb

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Amputees faces many difficulties to perform daily routine activities in their life. A limb with responding character based on sensor reading is not available in market for low prices. The purpose of the research is to develop an EMG controlled prosthetics limb with one degree of freedom at low cost. The prototype prosthetic leg was modeled using Solidworks software and then parts were printed using a 3D printer. Then, the assembled Prosthetics Lower Limb was controlled by an Arduino board interfaced with Electromyography sensors and stepper motors. Electromyography is a special method for evaluating and recording the electrical activity produced by skeletal muscles. It detects electric potential generated through human brain by movement of the muscle cells. Electromyography output signal was fed to the Arduino microcontroller which was programmed to acquire the angle and transformation of the natural limb based on its readings. Produced output signal was fed to the stepper motor through stepper motor driver. Then the prosthetic limb was actuated by linear stepper drives based on sensor reading, mimicking human limb. There, the Kalman filter was used to filter the EMG signal to minimize the noise. The modelled limb mimicked human limb with one degree of freedom. Efficiency of the system is low, as the quantity of sensors used is three instead of four which could produce more efficient signals. An average of threshold value for EMG signals should be found as it varies for each individuals. Modelling the system with at least three degree of freedom using four electromyography sensors is recommended as the future aspect for this project.

Keywords: Electromyography (EMG), Prosthetics leg, 3D modelling, Arduino, Kalman filter.