CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Upper limb muscles are essential for human to carry out the daily activities which include upper limb movements, such as dressing, bathing, playing smart phone, lifting object and etc. Some people who undergo accident or tragedy may affect them loss of the physical ability to use upper limb muscle for simple movements. Physical Medicine and Rehabilitation (PM&R) that aims to restore the function ability and quality of life to those disabled or injured people, they improve the existing robotic system to assist physically handicapped people can perform simple daily activities. Electromyography (EMG) can analyse and study muscle movement through nerve cells that located in the nervous system and manipulate motor neurons, which deliver electrical signals in order to generate the required data for the use of development in robotic arm movement. There are differences in the complexity of the muscle strength between males and females,
thereby in creating of the robotic arm for different genders, many aspects need to be taken into consideration. For example, the force or torque of muscle movement which produce by different genders are different.

Males are more prominent in the muscle strength comparing with females and this will affect the electrical signal produced by males and females also differently. Therefore, a comparison in EMG amplitude during Maximal Voluntary Contractions (MVC) of upper limb muscle between genders was probed to collect the required data for further study. Maximal Voluntary Contractions (MVC) is the maximum force which can produced by a human during some specific isometric exercises such as hand press, wall push off and etc. During isometric exercises, the muscle length does not vary and the affected joint also does not shift. Isometric exercises can help in enhancing stabilization by maintaining the position of the affected area. For example, isometric exercise may help someone who had been injured to stabilize the shoulder in order to maintain shoulder strength during recovery. EMG amplitude can be determined by calculate the root mean square (RMS), mean absolute value (MAV), integrated EMG (iEMG) and wavelength over the same contraction period by using the raw data recorded from subjects and perform calculations inside the MATLAB in order to find the results of EMG amplitude.

Surface Electromyography (sEMG) is a technique for assessing the muscle function by which the surface electrodes are positioned on human skin overlying muscle to detect and record the electrical signal of the muscle. When a muscle contraction signal was disseminate from motor neurons across the groups of muscle fiber, electrochemical and electrophysiological processes are take place which generate an electrically
computable polarization event known as action potential. By placing surface electrodes on the skin, sEMG can detect the action potential signals from different muscle fibers and each action potential will produce a particular amount of energy in electrical signal. The contraction intensity of muscle is manipulated by how frequently the action potentials arrive and excites the groups of muscle fiber. When the more frequently of the action potentials arrive, the muscle will contracts more forcefully and the level of sEMG signal will increases. The advantages of sEMG over other types of EMG are it does not need to involve piercing the skin and the participants do not feel hurt when they take the sEMG experiment.

1.1.1 Electromyography (EMG)

Electromyography (EMG) is an electro diagnostic technique for recording and measuring electrical activity generated in skeletal muscles in order to prevent neuromuscular diseases. Normally, the muscle is electrically silent when it is at rest, but if the muscle is active or during voluntary contraction, there will be an electrical current is generated out. When a person contracts his or her upper limb muscle more forcefully, there will be more groups of muscle fiber in arm are recruited and activated then causing more electrical activity during EMG testing. Motor neurons are nerve cells that located in the nervous system which help to deliver electrical signals that make muscles to contract. The responsibility of EMG is to translate these electrical signals into graphs or numerical data for specialists to study and evaluate. An electromyography machine contains electrode and recorder to detect and record the muscle stimulation during contraction in order to help diagnose muscle and nerve illness. From the EMG results,