

**FPT UNIVERSITY**

Capstone Project Document

**Device controlled by arm muscle tissue gestures**

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| **Capstone Project code** | DCG |

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# Definitions, Acronyms, and Abbreviations

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| **Name** | **Definition** |
| DCG | Device controlled by arm muscle tissue gestures |
| Thumb stick | An analog stick, sometimes called a control stick, joy stick or thumb stick, is an input device for a controller that is used for two-dimensional input. |
| EMG | Electromyography (EMG) is a diagnostic procedure to assess the health of muscles and the nerve cells that control them (motor neurons). Motor neurons transmit electrical signals that cause muscles to contract. |
| Electrode | Component to get EMG data. |
| Op-Amp | An operational amplifier (often op-amp or opamp) is a DC-coupled high-gain electronic voltage amplifier with a differential input and, usually, a single-ended output. |
| System | Including DCG device and the DCG computer application. |

# Report No. 1 Introduction

## Project Information

* + - Project name:

**Device controlled by arm muscle tissue gestures**

* + - Abbreviation: **DCG**
    - Product Type: **Device + Computer Application**
    - Start Date: **May 13th 2016**
    - End Date: **August 2016**

## Introduction

The human hand is quite an important tool that is utilized culturally across the globe. From flipping, to a thumbs up, both can have very different meanings in different parts of the world. It is what makes humans unique in the animal kingdom. When people give presentation, hand motion **increase the value of our message by 60%!** The best, most charismatic speakers and influencers know the importance of using hand gestures. Summarize, hand has been already an important tool in our lives. So now, why did we need to build a new controller but not using our wonderful hand, which already integrated, provided us many way to trigger, to control thing.

## Current Situation

Controller places an important role of electrical device. But still, nowadays, they are very inconvenient. Some are too big and heavy, which make user become clumsy to carry them. On the other side, some are small, which make them easily lost. And yes we have try to replace button with thumb stick to demonstrate two dimension input, but it hasn’t satisfy us.

And then motion controller appear, Kinect of Microsoft. Based around a webcam-style add-on peripheral, it enables users to control and interact with their console/computer without the need for a controller, through a natural user interface using gestures and spoken commands. Although the concept of motion controller from Kinect is new and interesting, Kinect still get negative feedback from user:

* Users don't always want to be running or jumping.
* A bit pricy cause need to be integrated with many peripheral.
* Need a lot of space.
* It sometimes doesn't catch on to user body movements.

## Problem Definition

Because of the current situation, people confront with many problems with their current controllers:

* The controller are too big or too small to carry.
* If our system change, we may have to redesign our controller physically.
* Too many button may cause mistaken for user pressing the wrong button.
* Button is difficult to learn.
* Integrated many peripheral will increase time for microcontroller to processing signal causing delay and decrease accuracy.
* Motion capture need a lot of space.

## Proposed Solution

With the development of modern medical technology, we can read and know our arm gesture via electromyography study, which means our hand gesture can be represent under number for electrical device can understand it. And hand gesture is our natural part of our body so we don’t have to learn how to use it. On the other hand, to read EMG signal, we have to attach our devices to our hand, incidentally, it becomes a wearable devices, which make it convenient and hardly lost when we are using it.

### Feature functions

This device will always record of the electrical activity of muscle tissue to recognize user gesture. After processing the devices transmit this data to user computer via wirelessly, and visualize user gesture to the computer screen if they are match with some action the computer application have learned. User can map their arm gesture with computer keyboard according to their desires actions.

### Advantages and disadvantages

#### Advantages:

* Quick and easy performance for user.
* User can define their own action.
* Wireless wearable device.

#### Disadvantages:

* Need good electrode for good signal.
* Power problem.
* May delay between user gesture, which is performing and which is showing on computer screen.

## Functional Requirements

### Device:

#### Get the EMG signal from User muscle:

Using component calls electrode, DCG devices can get the signal from user muscle. This signal amplitude is very small, only be presented as millivolt. That why we need the next stage of our requirement.



#### Amplifying and Filtering the EMG signal.

Amplifying signal will increase the signal characteristic (Amplitude, Frequency, Period, Phase)by using some component calls Op-Amp for microcontroller analog digital converter component can recognize the signal for us, and the filter part will get rid of noise to take the signal we actually need to continue to next phase.

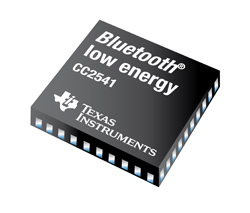
#### Digitizing the signal.

This phase will turn the analog signal to digital mode so that we can use this data which we will use to make a set of gesture. This part will be executed by using our main microcontroller.

#### Transfer the signal.

After digitizing signal we need to transfer to computer application, which has already contains set of gesture EMG. This transaction will follow Bluetooth protocol, which consume more energy than Wi-fi, suitable for wearable devices.

Notes: To satisfying our need, on the market, there are Microcontroller family CC26xx, CC25xx from Texas Instrument that contains 2 core controller unit, which will be able to integrated 2 mission: digitizing and transfer the signal.

### Computer Application:

#### Pair with the Device.

Computer application will have device manager part to notify and showing DCG devices connection to this application. We will also choosing/design an independent module to support computer that not support Bluetooth.

#### Get the EMG signal transferred from Device.

Background process that get EMG signal transferred from Device. This process will also follow Bluetooth protocol.

#### Mapping EMG signal with particular gesture EMG signal set.

This is also a background process with mission to compare and matching the EMG with set of EMG signal from gesture.

#### Visualize User gesture.

The Computer application also provide a window to show for user what gesture they are performing.

### User:

#### Mapping their gesture with particular computer action.

Computer application also provide for user a manager window, which user can map the gesture system has learn with their desired keyboard action.

## Role and Responsibility

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| --- | --- | --- | --- | --- |
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#### Table 1 : Roles and Responsibilities

# Report No.2 Task Plan

## Problem Definition