**MINISTRY OF EDUCATION AND TRAINING**

**FPT UNIVERSITY**

Capstone Project Document

**Communication by Your Hands**

|  |  |
| --- | --- |
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| **Capstone Project code** | CBYH |

-Ho Chi Minh City, **05/01/2016**-

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**Definitions, Acronyms, and Abbreviations**

|  |  |
| --- | --- |
| **Name** | **Definition** |
| CBYH | Communication by Your Hands |
| BOM | Back Office Management |

# Report No. 1 Introduction

## Project Information

* Project name: **Communication by Yours Hands**
* Project Code: **CBYH**
* Product Type: **Mobile application, BOM Website**
* Start Date: **05/01/2016**
* End Date: **<Ngày kết thúc>**

## Introduction

In communicating, sign language is the best way to communicate between people with deaf and mute. However, its required normal persons must have knowledge on sign language to communicate with the deaf and mute. Moreover, it is impossible for the deaf and mute to communicate with the blind. In this document, we introduce a solution for deaf and mute persons to communicate easily with the others without sign language knowledge on the normal person side.

We build a system, which help communication is easier between normal and deaf / mute persons. In the process of our research, we findout that MYO Gesture Control Armband is the key to solve the problem. By using MYO armband, we can read the electrical activity of person’s muscle and the motion of their arm then map the gesture with the customized data to translate sign language into text or sound with the same meaning. Beside that, we also provide an information system to manage easily the user, license packages and library packages.

This document also describes our working process in 4 months includes our perspective in the system, component designs and detailed core workflows. We all hope the system as so as our solution will help the deaf and mute persons easier to intergrate with the community.

## Current Situation

Currently, there is no official system that to support translate sign language into normal text or sound in VietNam or around the world. There is a project of Microsoft in China since 2013 named “Kinect Sign Language Translator” that use Kinect device to capture sign language movement to translate into spoken language and translate spoken language into sign language in real time. However, the project have not officially released yet.

So far, the most effective method for the deaf / mute persons to communicate is performing a combination of hands movement to describe a word or a phrase of words called “sign languge”.

There are special schools and organizations that teach deaf / mute persons (mostly children) how to use sign language to communicate in life.

Howerver, it is impossible to communicate between the deaf / mute with the blind.

## Problem Definition

Below are disadvantages of the current situation:

* Not use widly in community: In normal life, deaf / mute persons can hardly find someone who has knowledge on sign language to communicate.
* Normal turn into disabilities: It is quite hard for normal person who turn into deaf / mute accidentally to approach to sign language.
* Sign language is hard to learn: It takes time and difficult to learn sign language.

 Communicate between the deaf / mute with the blind: Sign language is useless on helping in communication between the deaf / mute with the blind.

## Proposed Solution

Our proposed solution is to build a system named “CBYH”, which use a pair of MYO armbands and an internet connected mobile device to help deaf / mute persons to communicate with the others easier by translate sign language from users into normal text or sound with the same meaning. We also design the system to be scalable so we can deploy this system on multiple platforms in future plan.

CBYH system includes a web application and a mobile application with following functions:

### **Feature functions**

* + - Web application (for staff):
      * Back Office Management: Staff can take manage on any user information, license and library database with this website.
    - Sign language training (mobile app for staff):
      * Training: Staff can add new sign language move and the meaning of it into database. Right after staff perform sign language, the application will receive raw data and the meaning of it, which is inputed by staff, then send and store them on server.
    - Sign language translator (mobile app for user):
      * Translate sign language: User can translate sign language into text or sound with the same meaning. Right after user perform sign language, the application will receive raw data from MYO armband and send to server then reveive translated data and outputs text or sound with the same meaning.

### Advantages and disadvantages

The advantages and disadvantages of the proposed solution:

* Advantages:
  + The communication between the deaf / mute with the normal persons: It is easier for deaf and mute persons to express what they want to say to normal persons. There is no need sign language on the normal to understand what the deaf and mute want to say.
  + Communicate between the deaf / mute with the blind: With the system, now the deaf and mute can communicate with the blind for the first time, which is impossible before.
  + The deaf and mute in there job: It is easier for the deaf and mute in there job especially whose job relate with presentation.
  + Mobility: To compare with “Kinect Sign language Translator” system, CBYH system’s user can translate sign language anywhere, anytime with a pair of MYO armbands and an internet connected mobile device.
* Disadvantages:
  + The delay of translation: There is delay in translation sign language into normal text or sound.
  + Lower accuracy: To compare with “Kinect Sign language Translator” system, the accuracy of sign language detection of CBYH system is quite lower.

## Functional Requirements

Function requirements of the system are listed as below:

* User component:
  + Translate sign language (online mode): User can translate sign language into text or sound with internet connection required
  + Buy license.
  + Switch: After buy license, user has three more functions to switch for personal use.
  + Translate sign language (offline mode): After buy license, user can download the meaning resource to device to translate sign language with no internet connection required.
  + Train custom hand sign: After buy license, user can create new sign move and meaning of that sign for personal use.
  + Share content: After buy license, user can create a group of device to receive translated data and stored in a list for personal use.
* Staff component:
  + Train standard sign language: Staff can train new sign language and meaning for system.
  + Manage database: Staff can take manage on database (User, license, library, sign language dictionary) with BOM website.

## Role and Responsibility

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No | Full Name | Role | Position | Contact |
| 1 | Kiều Trọng Khánh | Project Manager | Supervisor | [khanhkt@*f*pt.edu.vn](mailto:khanhkt@fpt.edu.vn) |
| 2 | Trương Công Thái | Developer, Tester | Leader | [thaitcse61209@fpt.edu.vn](mailto:trungdqse60994@fpt.edu.vn) |
| 3 | Nguyễn Nhất Nguyên | Developer, Tester | Member | [nguyennnse61172@fpt.edu.vn](mailto:phucnhse60749@fpt.edu.vn) |
| 4 | Phạm Hồng Quý | Developer, Tester | Member | [quyphse61130@fpt.edu.vn](mailto:tripqmse60746@fpt.edu.vn) |
| 5 | Nguyễn Duy Anh | Developer, Tester | Member | [anhndse61077@fpt.edu.vn](mailto:khanc60351@fpt.edu.vn) |

Table : Roles and Responsibilities

# Report No.2 Software Project Management Plan

## Problem Definition

### Name of this Capstone Project

-Official name: Communication by Your Hands

-Vietnamese name Phiên dịch ngôn ngữ kí hiệu

-Abbreviation: CBYH

### Problem Abstract

In daily life, communication is the one of the most basic needs and tool of humanity. There are many ways for people to communicate such as speech, body language, gesture, feeling, wrtting, texting, etc. However, with the deaf / mute persons, that basic need is hardly satisfied. The most effective current solution for them is sign language – a combination of hands movement that describes a word, or a phrase of words, which they want to express. Nevertheless, that means it requires ervery participants must have knowledge on sign language or there must be someone as a translator. In addition, the sign language cannot help deaf / mute persons communicate with the blind. Because of those, this is not a comprehensive solution and it takes lots of time and cost for training and learning sign language. In additional, there are still some temporary solution to solve the problem such as writing and texting, but these ways require a lot of time and effort. Moreover, those ways are not working in some situations with a group of people such as in a classroom or a presentation, etc.

To solve those problems, which mentioned above, we propose a solution that can help deaf / mute person use sign language to communicate with others who have no knowledge on sign language without person as a translator. This is a system includes a web service, a pair of MYO armbands and an internet connected mobile device. The system plays the translator role to translate sign language into normal text or sound.

### Project Overview

#### Current Situation and Disadvantages

Below are some current behaviors of user:

* Handwriting:
* People will use something can write on as vehicle for communication.
* They can write out exactly what they want to say to the recipient.
* The recipient can receive and read the content immediately.
* Familiar signs:
* Speakers will describe the word which they want say through action; describe the shape, body language.
* Listeners observe the speaker's actions. They predict information that the speaker shown.
* Interpreters:
* Act as intermediary to translate the content of communication.
* Speakers express words by their language, the interpreter receive information from the speaker and then convey that information by the language of the listener.
* Degree of accuracy of translated content is quite high for both two sides.

Below are the disadvantages of current situation:

* Hand-writing :
* Users must use an intermediary for communication such as paper, pens. However, these things are not always available.
* Users spend more time to write out all their wishes and read them.
* User can meet difficulties about different languages.
* The error can be caused by user handwriting.
* Using familiar signs :
* Maybe be misleading because the symbols are not standardized.
* It is trending towards personally identifiable user.
* It is difficult to show all wishes of communicator.
* Time consuming for understanding the content is long.
* Translator :
* Hiring a translator must be costly.
* Translator who work only in the fixed time, thus not always can meet user's demands.
* Translator must be an experienced person.
* Number of translator is limited.

Analyzing image is the most common way to solve many problems in the real life. One of those problems is recognition. Today, with growth of supported analyzing image library and algorithms provided to process image is widespread, tracking and recognition can be performed more easily. Our project is taking into consideration about it to recognize hand signs to help people can communicate with another people.

* Advantages:
* The system can be implemented on many different platforms.
* Operating costs are less expensive.
* Recognition is implemented quickly by many image-processing algorithms.
* Disadvantages:
* Analyzing image is still remains restriction on process environment, point of view.
* Recognition has still not covered every case yet. Within weird characterizes, the result maybe not high accurate.
* Currently, analyzing image and recognition just detect and recognize hand signs without motion.
* To get high degree of accuracy, it requires some accessories from users.

#### The Proposed System

Exploiting the development of embedded technology and the growing of image processing, we put forward a system which can recognize hand sign language to help dumb people can communicate. This system includes a camera, which captures hand signs from user, a raspberry board plays role as central processing unit that analyzes these captures, processes some algorithms to recognize them and performs some different functions in the system, and a LCD that shows interfaces of the system and recognition result. Besides that, the system still provides some electronic devices to user can control battery, or devices.

##### Controlling System

* Users can turn on/off the system by a switch button.
* Users use hand gestures to select the functions and move between functions.

##### Portable System

* Users can monitor the battery capacity.
* Users can charge battery.

##### Hand Sign Language Recognize

* Users express hand gestures, which describe the desired content, and then they can receive the hand sign recognition result.
* Users can see your hand gestures on LCD.
* Users can check the result of the current hand sign.
* Users can edit the current translated content.
* Users receive the recognition result via text or sound shown from LCD.

##### Learning Hand Sign

* Users can choose words that they want to learn which existed in the system.
* Users can see images, which expresses the hand gesture.
* User's hand signs can be practiced and checked by following some steps of the system.
* Users receive the current recognized result of the hand sign via text or sound.

#### Boundaries of the System

##### The restrictions

* The system language is Vietnamese.
* Hand sign language the system supports is Vietnamese sign language.
* The system just recognizes no motion hand signs.
* The system requires users must use supported accessories.
* The system requires users must provide a stable environment in room with sufficient light and a background is not complex on color, especially, no color close to skin color. If the background is not suitable, user must use the background which is provided by the system
* User must wear the accessory, which is provided by the system such as black bracelet.
* The system must be fixed during the working process.

##### The components of the system:

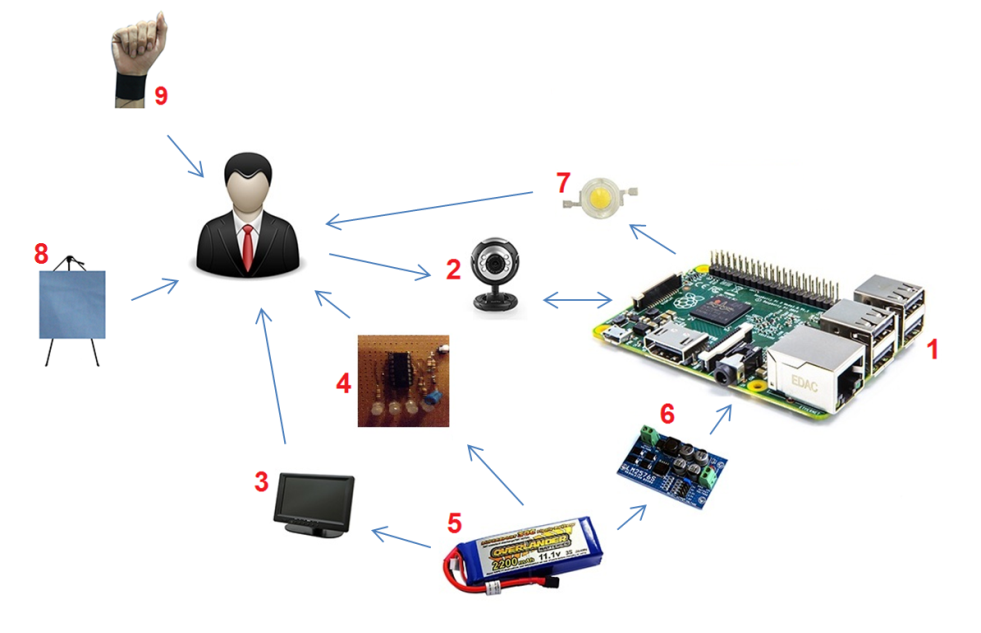


Figure 1: Components of the system

|  |  |
| --- | --- |
| **No.** | **Component’s Name** |
| 1 | Raspberry |
| 2 | Camera |
| 3 | LCD |
| 4 | Battery Capacity Display Circuit |
| 5 | Lipo Battery |
| 6 | LM2576ADJ - 3A UNI REG Board |
| 7 | LED |
| 8 | Accessory: fixed background |
| 9 | Accessory: black bracelet |

Table 2: Component’s Name

#### Development Environment

##### Hardware requirements

* + - Four laptops are used for development the system. These are setup Ubuntu 14.04 operating system.
    - Raspberry Pi B2 is used to process as central processing unit.
    - Micro SD card 16GB: is used to setup Raspbian operating system
    - Cable HDMI to HDMI: connect Raspberry to LCD
    - Cable is connection between laptop and raspberry pi B2.
    - Keyboard, mouse, and usb wifi are used to setup operating system and necessary environments for raspberry pi B2.
    - Backup flash memory: a backup solution when problems with operating system. This memory must be setup similar to main flash memory.
    - LIPO 3 cells battery (12V – 2700mA): power for the system can works.
    - Logitech C270 Webcam: is used to capture images.
    - 7 inch HD TFT Color Monitor LCD: is used to show the interface of functions and the recognized results.
    - 1 Led (1W 350mA): is used to balance light.
    - LM2576ADJ-Board - UNI Regulator Board: conversion from higher to lower DC voltages
    - TL084 + zener 5.1v are used to monitor battery capacity.
    - Accessories: black bracelet and fixed background.

##### Software requirements

* + - Operating system and platform for deployment and development: Ubuntu 14.04 for laptop and Raspbian for Raspberry PI B2.
    - Remmina Remote Desktop Client: application for remoting to work on raspberry.
    - QT Creator version 4: is to develop C++ application and Linux GUI.
    - OpenCV 2.4.9 library: support image processing.
    - LIBSVM library version 3.20: support SVM for recognition.
    - BCM2835 1.45 library: allowing access to the GPIO pins on the 40 pin IDE plug on the RPi board
    - Espeak 1.48.04 library: open source software speech synthesizer for English and other languages, for Linux and Windows
    - SQLite 3: software creates and manages the system database.
    - Software Ideas Modeler: application for creating models and diagrams.
    - Microsoft Office 2010: is used to write documents and assign tasks.
    - Githup and TortoiseSVN and Rabbit VCS: used for source control.
    - Skype: used for communication and meeting.

## Project organization

### Software Process Model

#### Overall Description

Scrum is an agile methodology that can be applied to nearly any project; however, the Scrum methodology is most commonly used in software development. The Scrum process is suited for projects with rapidly changing or emergent requirements. Scrum software development progresses via a series of iterations called sprints, which last from one to four weeks. In the agile Scrum world, a sprint-planning meeting is described in terms of the desired outcome (a commitment to a set of features to be developed in the next sprint) instead of a set of Entry criteria, Task definitions, Validation criteria, Exit criteria. The Scrum model suggests each sprint begins with a brief planning meeting and concludes with a review. These are the basics of Scrum project management.

#### Scrum Development Model



Figure 2: Scrum Development Model

For more information: [**https://www.scrum.org/Resources/What-is-Scaled-Scrum**](https://www.scrum.org/Resources/What-is-Scaled-Scrum)

#### Reasons for Choosing

Project is developed under scrum model. We choose this model because the scope of the project is not fixed when the requirement changes day by day. Products are created quickly. Therefore, the development team can easy to change if the wrong direction. Degree of cooperation between the members is set to high.

### Roles and responsibilities

|  |  |  |  |
| --- | --- | --- | --- |
| No | Full name | Role in Group | Responsibilities |
| 1 | Đỗ Đức Minh Quân | Scrum Master/Product Owner | * Defining user requirements * Specifying business * Control the development process * Give advices on techniques, solutions and business analysis support |
| 2 | Nguyễn Đức Lợi | Scrum Master/Product Owner | * Give advices on techniques, solutions and business analysis support |
| 3 | Nguyễn Hữu Kỳ Long | Team Leader, BA, DEV, Tester | * Managing process * Clarifying requirements * Researching solutions and techniques * Assigning task for members * Reviewing the result of task of members. * Editing documents and reports * Reviewing documents and reports * Developing the system software * Reviewing the system hardware * Coding * Creating test plan. * Testing |
| 4 | Nguyễn Đình Tân | Team Member, BA, DEV, Tester | * Clarifying requirements * Researching solutions and techniques * Designing database * Preparing documents and reports * Reviewing documents and reports * Developing the system software * Reviewing the system hardware * Coding * Testing |
| 5 | Lê Phương Bình | Team Member, BA, DEV, Tester | * Clarifying requirements * Preparing documents and reports * Reviewing documents and reports * Developing the system hardware * Reviewing the system software * Coding * Testing |
| 6 | Nguyễn Xuân Ý | Team Member, BA, DEV, Tester | * Clarifying requirements * Editing documents and reports * Reviewing documents and reports * Developing the system hardware * Developing the system software * Coding * Testing |

Table 3: Roles and Responsibilities Details

### Tools and Techniques

* + - Front-end and back-end IDE:
* QT Creator version 4
  + - Front-end technology:
* QT Linux GUI version 4
  + - Back-end library:
* OPENCV library version 2.4.9
* LIBSVM library version 3.20
* Espeak library version 1.48.04
* BCM2835 library version 1.45
  + - Managing database:
* SQLite 3
  + - Connecting to Raspberry PI B2:
* Remote Desktop Connection Program of Ubuntu 14.04
  + - Managing the project:
* SVN tortoise version 1.8.11
* Rabbit VCS
  + - Managing documents, reports, models and diagrams:
* Software Ideas Modeler version 7.70.5385.38708
* Microsoft Office 2010

## 

## Project Management Plan



### Product Backlog

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ID | Theme | User Type | Wants to... | So that... | Priority | Sprint |
| 1 | Detection | User | keep track their hand gesture | can see his/her hand in the screen | Very High | 1 |
| 2 | Device | User | the system is a portable system | move the device easily and use it more flexibly | High | 1 |
| 3 | Recognition | User | recognize the hand signs | express the same meaning to the partner can understand | Very High | 2 |
| 4 | Recognition | User | receive the recognition result via text and sound | express the translated content in a clearly way | Medium | 2 |
| 5 | Detection | User | control the system functions by hand gesture | perform and move beetween the system functions | High | 3 |
| 6 | Power | User | know remaining of battery capacity | can monitor the use of device | Medium | 3 |
| 7 | Recognition | User | increase the accuracy of the recognition result | raise the reliability of the translated content | Very High | 4 |
| 8 | Learning | User | learn the hand sign language | learn new signs or pratice his/her signs | High | 4 |
| 9 | Device | User | turn on/off the system | can turn on/off the device according to the demand | Medium | 4 |
| 10 | Device | User | the system is boxed firm, compact | the component are protected against bumps | Medium | 5 |
| 11 | Recognition | User | the system reliable operation | no error occurs when using | High | 5 |
| 12 | User manual | User | know how to install and use the system | easy to use, repair | High | 5 |

Table 4: Product Backlog Details

### Sprint Backlog

Place at folder ScrumBacklog in Github



### All Meeting Minutes

Place at folder ScrumBacklog in Github

## Coding Convention

*General view of C++ Programming Style put into practice in the project*

* Naming Conventions
* Variable names must be in mixed case starting with lower case.
* Named constants must be all uppercase using underscore to separate words.
* Names representing methods or functions must be verbs and written in mixed case starting with lower case.
* Plural form should be used on names representing a collection of objects
* The prefix is should be used for Boolean variables and methods
* Include Files and Include Statements
* Header files must contain an include guard
* Include statements should be sorted and grouped
* Include statements must be located at the top of a file only
* Variables
* Class variables should never be declared public
* C++ pointers and references should have their reference symbol next to the type rather than to the name
* Conditionals
* Complex conditional expressions must be avoided
* The conditional should be put on a separate line
* Executable statements in conditionals must be avoided
* Comments
* Use // for all comments, including multi-line comments
* Comments should be included relative to their position in the code
* Class and method header comments should follow the JavaDoc conventions

*References*

C++ Programming Style Guidelines, Version 4.9, January 2011, Geotechnical Software Services, Copyright © 1996 – 2011

<http://geosoft.no/development/cppstyle.html>