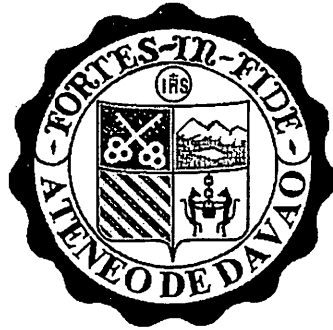


**DEVELOPING AN AMERICAN SIGN LANGUAGE INTERPRETER  
USING MICROSOFT'S KINECT™**



**By**

**Lex Marion Bataller**

**Paolo Villanueva**

**Jerrico Sevilla**

**SCHOOL OF ARTS AND SCIENCES**

**ATENEOD DE DAVAO UNIVERSITY**

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USING MICROSOFT'S KINECT™**

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**By**

**Lex Marion Bataller**

**Paolo Villanueva**

**Jerrico Sevilla**

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## ABSTRACT

This research aims to investigate the approach of applying the hidden Markov model in recognizing American Sign Language for the Xbox 360 Kinect™ device. Kinect™'s patent clearly states its capability to recognize American Sign Language and convert it to its spoken or text equivalent but has been excluded in the final release. OpenCV, a library of functions used for computer vision has been popular for manipulating digital images and videos thus essential for recognizing sign language due to its powerful libraries and functions focused on Computer Vision.

The research focuses on using OpenCV libraries to work with the Kinect™ in recognizing American Sign Language for two ways. One is for recording signing data to its text equivalent. Second is for interpreting signing to its text equivalent assuming the first has taken place. In this paper, the researchers would like to present a method for detecting and analyzing sign language through hand gesture recognition using Microsoft Kinect™ through contour detection and pattern matching.

### ***Keywords:***

*Hand gesture recognition, Kinect™, American sign language detection, Microsoft, libfreenect, OpenCV*

## CHAPTER 1

### INTRODUCTION

#### 1.1. Background of the Study

Sign Language is a method of communication between the hearing- and speech-impaired and speaking individuals. So far, there has been no layer of communication between the hearing and speech impaired individuals and the hearing individual or through the internet without leading the hearing and speech impaired individuals to conform to typing or writing as methods of communication. Other than by typing or writing, the hearing- and speech-impaired can only communicate with regular hearing and speaking individuals through hand signals with those who do not know sign language and even then, communication may not be accurate. Since improvised hand signals are non-standard and not universally understandable by those who use standard sign language, what is needed is a way by which sign language can be translated into text. Hand Gesture Recognition may present this opportunity to automate the translation of sign language to text.

Hand Gesture Recognition such as those in sign language may be converted to a form of communication that is understandable to regular hearing and speaking individuals via algorithms through implementation using OpenCV.

This study intends to use Kinect™ to recognize hand signs. Kinect™ is based on a software technology developed by Rare, a subsidiary of Microsoft

Game Studios and range camera technology by Israeli developer PrimeSense which interprets information from continuously projected infrared structured light. The Kinect™ hardware was recently released last year on November 4, 2010. Its sensor provides full body 3D motion capture, facial recognition and voice recognition abilities only available and used for the Xbox 360 Console. After the release of the Kinect™ there have been numerous attempts to access the capabilities of the hardware leading to the development of Libfreenect then after Open Kinect™, a community of people interested in using the Kinect™ hardware and other devices.

Libfreenect is an open source driver to access data input from the Kinect™ sensor for various use and developments in a computer platform. Libfreenect is written using Git, and is compatible with common computer languages such as C++, Java, Python, Javascript and C#. Libfreenect has open source libraries which enable the Kinect™ to be used with Windows Linux and Mac.

So far, there have been various submissions in the use of the Kinect™ sensor, such as a wireless mouse, interactive piano, painting in 3D space, multi touch navigation but so far most of these projects are still in prototype stages. But nevertheless the projects themselves have documentation and the data readily made available. With this expansion of projects Prime Sense has decided to publicly release its driver for the Kinect™ called Open NI which also allows developers to access the capabilities of the Kinect™. With the two drivers, Open NI and libfreenect publicly available numerous projects have been rapidly

increasing demonstrating how the Kinect™ sensors power can do more than what was advertised.

## **1.2. Problem Statement**

The study seeks to investigate an approach to use OpenCV in recognizing American Sign Language to accommodate the inclusion of sign language recognition feature of the Kinect™. Specifically, the study aims to answer the following questions:

- What relative concepts of OpenCV can be applied to the Kinect™?
- How to recognize sign gestures using the libraries in OpenCV?

## **1.3. Objectives of the Study**

The study focuses on finding an appropriate approach of using OpenCV in recognizing American Sign Language using the Kinect™.

The study has the following specific objectives:

- Determine OpenCV concepts applicable to the Kinect™
- Identify relevant libraries in sign gesture recognition

## **1.4. Significance of the Study**

The study hopes to open possibilities, through advanced technology, of exploring possible ways of communicating with the non-speaking population and for them to communicate with the speaking population. Since text is used all over the web, mostly the people who can communicate through are those who

see, read and write. This includes individuals who are mute but are trained to write. Thus, there is a barrier for people who are mute and unable to write or type to communicate through text. Thus a translator from sign language to text would be very beneficial in applications like search engine tools, chat, messengers, video games and language translators since the commonly used method in interpreting sign language used today is still the person to person approach. This means, another individual with knowledge of sign language would have to interpret the language for the receiver.

With these reasons, a study regarding Sign Language interpretation through Kinect™ using a hand gesture recognition system approach will contribute significantly to the deaf and mute literacy and communication sectors. This would benefit them for use in the web and open possibilities for more research in the understanding and interpretation of gestures through the Kinect™.

### **1.5. Scope and Limitations of the Study**

The study is geared to the application of OpenCV libraries in the recognition and conversion of ASL to its text equivalent. Application of the

libraries of OpenCV is by consideration of the Kinect™'s specification and its capability in gesture recognition.