VIRTUAL PIANO KEYBOARD USING WEB CAMERA

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VIRTUAL PIANO KEYBOARD USING WEB CAMERA

WANG JEN NING

This report is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science (Computer Security)

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FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
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2016

DECLARATION

I hereby declare that this project report entitled

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is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date : 17.08.2016

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I hereby declare that I have read this project report and found this project report is sufficient in term of the scope and quality for the award of Bachelor of Computer Science (Computer Security) With Honours.

SUPERVISOR : _____ Date : 17.08.2016.

(PM. DR. NOR AZMAN BIN ABU)

DEDICATION

To my respected supervisor, Professor Madya. Dr. Nor Azman Bin Abu, thank you for the patience guidance by teaching and explaining the theory upon project completion.

To my beloved family, thank you for the given mentally support and caring upon project completion.

To my housemates and roommate, thank you for sharing valuable time by sharing relevant knowledge upon project completion.

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ABSTRACT

This project is mainly focus on the technique used to perform finger tracking. The objective of this study is to provide an alternative pathway for performance in real time finger tracking applications that involve image processing equipped with affordable hardware. The virtualized environment allows user to experience playing piano keyboard by using web camera. This may provide an alternative pathway for piano performance without the limitation of location, instruments and cost. On top of that, web camera and image subtraction algorithm will be used to implement and test to achieve best accuracy in finger tracking upon the completion of this development.

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ABSTRAK

Projek ini telah memberi tumpuan kepada teknik yang digunakan untuk melakukan pengesanan jari. Objektif kajian ini adalah untuk menyediakan satu laluan alternatif untuk prestasi dalam masa sebenar dengan menggunakan aplikasi pengesanan jari yang melibatkan pemprosesan imej serta perkakasan berpatutan. Persekitaran maya membolehkan pengguna untuk mengalami bermain keyboard piano dengan menggunakan kamera sesawang. Hal yang demikian telah menyediakan laluan alternatif untuk prestasi piano tanpa had lokasi, peralatan dan kos. Selain itu, kamera sesawang dan algoritma penolakan imej akan digunakan dalam pembinaan system dan ujian untuk mencapai ketepatan terbaik dalam mengesan jari setelah selesai pembangunan ini.

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LIST OF ABBREVIATIONS

NITE	Natural Interaction Middleware
fps	Frame per Second
HVC	Horizon View Camera
SDK	Studio Development Kit
API	Application Programming Interface
MIDI	Musical Instrument Digital Interface
SDLC	Software Development Life Cycle
ROI	Region of Interest
DFD	Data Flow Diagram
ERD	Entity Relationship Diagram
RAM	Random Access Memory
FYP	Final Year Project

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CHAPTER I

INTRODUCTION

1.1 Introduction

Image processing is a process that involves images by using mathematical operations in any form of signal processing. (Harshal, G.D., Ganesh, R.B., Ganesh, E.K., Sachin, R.K. and Bendale, S.P., 2015) In the field of technology and image processing, the technique of tracking the movement of fingers in front of a web camera is highly demanded. (Kinjal, N.S., Kirit, R.R. and Shardul, J.A., 2014) This is because the availability of high speed processors and inexpensive web cameras could benefits people in real time applications that involve image processing. (Shaker,N. and Zliekha,M.A., 2007) Therefore, this project was proposed to introduce the development of virtual piano keyboard which implement the technology of finger tracking. This development will be divided into two parts. The first part is having a piano keyboard on screen of the monitor for visual effect and performance. Secondly, a portable web camera is placed on the user side to capture image for tracking finger movement.

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1.2 Problem Statement

This project is brainstormed from the lacking of virtualized piano keyboard for performance in real time finger tracking applications that involves image processing. The current musical performance was still implementing physical piano instruments which are cost expensive and lack of flexibility. Therefore, this motivates the creation of virtual piano keyboard by using the technique of image processing to perform finger tracking. It provides an alternative pathway for piano performance without the limitation of location, instruments and cost. At the same time, the development shall be applicable for other types of platform such as learning and entertainment.

Table 1.1 Summary of Problem Statement

PS	Problem Statement
PS_1	The physical piano keyboard involved in performance is expensive and lack of flexibility.

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1.3 Project Question

Based on the problem statement that discussed in Section 1.2, the project question on how the new creation of system by using finger tracking technology that collaborate with image processing can provide cost effective and high flexibility of piano keyboard usage was arisen. The user-friendly interfaces and functionality of the system will be explained in detail as the system developed. The direction of system development will be followed the project question as a center of guidance to minimize the error.

Table 1.2 Summary of Project Question

PS	PQ	Project Question
PS_1	PQ_1	How can the development of virtual piano keyboard provide a platform in cost effective and high flexibility way by implement

		finger tracking technology that collaborate with image processing?

1.4 Project Objective

The objective of creating this system will be listed as below:

1) To study the technology of finger tracking that collaborates with image processing technique. This technique is highly needed in order to produce a real time finger tracking application.
2) To develop virtual piano keyboard for performance, learning and entertainment platforms. The application aims to provide alternative pathway in cost effective and high flexibility way for user.
3) To test the application in laptop by using the software Matlab R2010a and portable web camera. The testing process is important to verify the application for future used.

Table 1.3 Summary of Project Objectives

PS	PQ	PO	Project Objective
PS_1	PQ_1	PO_1	To study the technology of finger tracking that collaborates with image processing technique.
		PO_2	To develop virtual piano keyboard for performance, learning and entertainment platforms.
		PO_3	To test the application in laptop by using the software Matlab R2010a and portable web camera.

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1.5 Project Scope

The software requirement for the project development will be listed as shown below:

1) Matlab R2010a

Matlab R2010a is used for image processing and finger tracking.

2) Web Camera

The web camera is used to capture the image of fingers for further analysis.

1.6 Project Contribution

This system will be benefits all users who had intention to use piano keyboard for learning, performance or entertainment purposes. The features designed in the system will introduced a cost-effective and high flexibility virtual piano keyboard which enable user to implement it without limitation of location, instrument and cost. This provides a better experience for musicians in performance and aspiring normal user to learn and enjoy music. Besides that, the virtual piano keyboard was designed to improve the visual effect when playing piano. The expectation from this project will be providing a multiplatform with the combination of low cost web camera and finger tracking technique which collaborates with image processing. This project wished to contribute a basic building block of virtual piano keyboard in real time application for further development with added features.

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Table 1.4 Summary of Project Contribution

PS	PQ	PO	PC	Project Contribution
PS_1	PQ_1	PO_1	PC_1	Proposed suitable techniques for virtual piano keyboard application.
		PO_2	PC_2	Proposed a high flexibility virtual piano keyboard for multiplatform.
		PO_3	PC_3	Proposed an application which using the combination of low cost web camera and image processing collaborate with finger tracking technology.