UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF HAND GESTURE GLOVE TO CONTROL ROBOT ARM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Industrial Automation and Robotics) with Honours

by

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2016

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Development of Hand Gesture Glove to Control Robot Arm**

SESI PENGAJIAN: **2016/17 Semester 1**

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I hereby, declared this report entitled “Development of Hand Gesture Glove to Control Robot Arm” is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Industrial Automation and Robotics) with Honours. The member of the supervisory is as follow:

……………………………….

(**EN MOHD HANIF BIN CHE HASAN**)

ABSTRAK

Sistem Gerak Isyarat Tangan (HGG) adalah alat kawalan untuk menggunakan Interaksi Manusia-Mesin konsep (HMI). Bagi HMI adalah teknologi interaksi yang terbagus antara seorang manusia dan mesin. Yang pentingnya bagi konsep HMI adalah menyebabkan mesin atau robot boleh menggantikan manusia untuk melakukan lebih banyak kerja di kawasan berbahaya dan juga di kawasan-kawasan yang tidak boleh dilarangkan oleh manusia. Bagi Gerak Isyarat Tangan peranti kawalan adalah kawalan dengan isyarat tangan manusia. Konstruk ini adalah berdasarkan 3 Axis meter pecutan, sensor flex dan termasuk teknologi antara muka wayarles. Dan kawalan tindakan peranti atau gerakan ini adalah kebebasan dan fleksibel daripada pengawal peranti lain seperti “keyboard”, “joystick” dan “PC mouse”. Kegunaan untuk projek ini adalah untuk Robotic Arm.

ABSTRACT

A Hand Gesture Glove (HGG) is a control device, using Human-Machine Interaction (HMI) concept. A HMI is great interaction technology between a human being and a machine. An important the HMI in Robot arm that is because the machine or robot can replace human to do more work in dangerous areas and also in the areas which cannot be accessed by human. The Hand Gesture Glove control device is control by human hand gesture. This is construct based on 3 Axis Accelerometer, flex sensor and including the wireless interface technology. And this control device action or motion movement is freedom and flexible than the other device controller such a keyboard, joystick and PC mouse. The developed devise is applied to Robotic Arm and further evaluated it performance.

DEDICATIONS

To my beloved parents

To my beloved family members

To my trusty friends

ACKNOWLEDGMENTS

By the way, I wanted to thank a lot for him my supervisor, En Mohd Hanif Bin Che Hasan encouragement, suggestions and trusted during the period of this first semester Final Year Project (FYP). My supervisor, is very smart person is because him are try to explain more and give more clearly example with new ideal for me. My supervisor, discuss with me how to write a good FYP report and also get the ideal about how to develop hardware project. Last, I also want to thank my trusted friends. They also given a good response when I asking a question during my FYP section and also example the ideal for me to smoothly finish this first semester FYP project this semester.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLE

LIST OF EQUATION

LIST OF SYMBOLS AND ABBREVIATIONS

HGG	=	Hand Gesture Glove
HMI	=	Human-Machine Interaction
FYP	=	Final Year Project
IR	=	Industrial Robot
MEMS	=	Micro Electro Mechanical System
3D	=	Three Dimension
X	=	X-Axis
Y	=	Y-Axis
Z	=	Z-Axis
DOF’s	=	Degree of Freedoms
LED	=	Light Emitting Diode
ARM	=	Acorn/Advanced RISC Machine
PIC	=	Peripheral Interface Controller
SR	=	Synchronous Sign Magnitude Rectification
DC	=	Direct Current
PWM	=	Pulse Width Modulation
AVR	=	Modified Harvard Architecture 8-bit RISC
RISC	=	Reduced Instruction Set Computing
ROM	=	Read-Only Memory
EPROM	=	Erasable Programmable Read-Only Memory
EEPROM	=	Electrically Erasable Programmable Read-Only Memory
KHU-1	=	3D Hand Motion Tracking and Gesture Recognition System
RC car	=	Radio Controlled
PC	=	Personal Computer
NXT	=	Next Generation
RF	=	Radio Frequency
PID	=	Proportional Integral Derivative
UTeM	=	Universiti Teknikal Malaysia Melaka
IDE	=	Integrated Development Enviroment

USB	=	Universal Serial Bus
COM Port	=	Serial Port
EMA	=	Exponential Moving Average
UNO	=	Arduino UNO
WF	=	World Frame
G	=	Gripper Frame
W	=	Wrist Frame
S	=	Shoulder Frame
E	=	Elbow Frame
B	=	Base Frame
T	=	Transition
T1	=	Transition 1
T2	=	Transition 2
T3	=	Transition 3
DH-Table	=	Denavit-Hartenberg Table
TX	=	Transmission Bluetooth
RX	=	Receiver Bluetooth

CHAPTER 1

INTRODUCTION

What is Robotics? When mentioning robots, many people will think about machines with hands and feet. That is because many type of scientific movies, entertainment and toy stores are showing this kind of robot. Actually, robotic engineer can develop many shape or type of robot to helping people to do more difficulty work such as robotic arm, car, quadcopter and other type of robot. Difference type of robot got deference types of robot application. There are Industrial robots, Domestic or household robots, Medical robots, Service robots, Military robots, Entertainment robots, Scape robots, Hobby and Competition robots. In this paper, just want to show only the type of robot application is Industrial robots. The Industrial robots are robots used in an industrial manufacturing environment. Usually these are articulated arms specifically developed for such applications as welding, material handling, painting and other.

1.0 Background Project

A gesture is a non-verbal or non-vocal communication which produced by our human body. Gesture also can call that as a human body language. To study human gesture also given many type of gesture such as hand, arm, leg, body and face.

In this paper, just focusing how to use the human gesture to make an instruction to ask the robot to do work. Mean that to convert the gesture signal produced by human hand or arm to a form of digital signal to control robot to do work like similar with human. The concept used in this paper is called as Human-Machine Interaction (HMI). The hand gesture includes several type gesture there are Palmar or Tripod grasp, Lateral grasp, Wrist Extension, Wrist Flexion, Move Hand or Arm Forward or Backward, Move Arm Left and Right, Cylindrical grasp, and Grasping.

The human gesture can easily the snap or capture using the type of glove including some electronic sensor devices with the high performance microcontroller and to communication with Industrial Robot Arm in professional can apply high technology wireless interface. The electronic sensor devices are only 3 Axis Accelerometer Sensor and Flex Sensor is choosing. Because the 3 Axis Accelerometer can provide 3D orientation and movement that is slightly similar with human gesture movement or orientation. Flex Sensor is using for controlling the gripper or other tool can apply at Industrial Robot Arm. This system can recognize any sampled data saved in the database while promoting maximum portability and mobility to the user via wireless Bluetooth technology rates relationships.

1.1 Objectives

The objectives of the project are as follows:

a. To study the concept of hand gesture glove to control robot arm wireless interface.
b. To design the hand gesture glove to control robot arm.
c. To analysis the performance whether the hand gesture glove can be smoothly and directly replacing other devices controller to control robot arm.

1.2 Scope

The scopes covered for this project is the wireless hand gesture control device. It device is construct based on accelerometer sensing in 3D environment. Implementation allows user to wear a set of hardware (glove) and control a robot movement through different hand movement and orientation. The Robot Arm movement directions including move in up, down, left or right and pick up some objects form another place and beside that the movements of the human hand gesture by using accelerometer sensor to scan and follow the acceleration of human hand movement. The scope of accelerometer sensor can be provided 3D movement similar with human gesture.

For the robot arm gripper that will be using flex sensor to control whether grip open or close because flex sensor is a passive resistive device that can be used to detect bending. There is a change in resistance depending on the amount of bend on the sensor. As the amount of bend increases the resistance increases and the gripper will be closed.

The type of wireless interface is using Bluetooth device to communicate in between hand gesture glove and robot arm. Every signal receives or transmit that will be manipulate by microcontroller Arduino Uno.

The performance analysis is focusing to get the best wireless communication between hand gesture glove and robot arm. Next, is get the best performance analysis when the position movement of robot arm is exactly similar will the hand gesture glove position movement are provided.

1.3 Problem Statement

Now, the world wide is near to the new technology world. The new technology world is coming to changing our human to be stress and hard to control the new technology for certain people are no scholar and also focus to make human become lazier to do more work. For example, the new technology now is controlled by using keyboard, joystick, switch button and include touch screen sensor. That will become more difficult for our human are no scholar to control. Since, now many of people is still having a problem to find permanent joy for their life because of not enough of knowledge and less confidence for controlling the Robot or Machine. That will be a big problem statement because of coming a new technology world.

At the same time, our robotic engineer is developing some new controller to replacing the traditional controller devices. The new controller device is using Human-Machine Interaction concept. This Human-Machine Interaction concept has called as a HMI concept. The structure is using combination of our human and machine to interaction. The functionality of this HMI concept is using our human gesture to communicate with the machine or robot. Other way to describe in this HMI concept is the development in science and robotic combine. Gesture recognition can be considered as a way for computer to understand human body language.