

TUFFAH WAJAH
INTELLIGENT HUMAN COMPUTER INTERACTION SYSTEM

BILAL LUQMAN BAYASUT

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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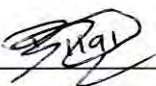
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INTELLIGENT HUMAN COMPUTER INTERACTION SYSTEM

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This Report is submitted in partial fulfillment of requirements for the
Bachelor of Computer Science (Artificial Intelligence)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2011

DECLARATION

I hereby declare that this project 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: 18 July 2011

(BILAL LUQMAN BAYASUT)

SUPERVISOR :



Date: 18 July 2011

(DR. GEDE PRAMUDYA ANANTA)

DEDICATION

To my parents, Luqman Faruq Bayasut and Afifah Bin Thalib;

My siblings, Maryam Binti Luqman Bayasut and Sumayyah Binti Luqman Bayasut

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Indeed, I would like to thank to Allah subhanahu wa-ta'ala for giving me opportunity and ability to finish this project.

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ABSTRACT

This project is performed to develop a system that is expected to be able to help disabled people to have full control of computer mouse so that they can still operate computer like normal people do. An idea behind this project is a fact that the emergence of difficulties for disabled people to interact with computer. For instance, paralyzed people are unable to control computer mouse, hence this project was conducted. This project only uses webcam as an input which captures the user's head and then tracks their head movement and iris in order to do mouse actions. It is done by using some image processing techniques such as: Component localization, Haar cascade classifier and Hough transform.

ABSTRAK

Projek ini dilakukan untuk membangunkan suatu sistem yang dijangka akan dapat membantu orang kurang upaya untuk mempunyai kawalan penuh terhadap tetikus komputer supaya mereka masih boleh mengendalikan atau menggunakan komputer seperti orang biasa, Idea di sebalik projek ini adalah suatu fakta bahawa munculnya kesukaran bagi orang-orang kurang upaya untuk berinteraksi dengan komputer. Sebagai contoh, orang lumpuh tidak dapat mengawal tetikus komputer, maka projek ini telah dijalankan. Projek ini hanya menggunakan webcam sebagai input yang menangkap kepala pengguna dan kemudian mengesan pergerakan kepala dan mengesan iris pengguna untuk melakukan tindakan klik pada tetikus komputer. Dengan menggunakan beberapa teknik pemprosesan imej seperti : Component localization, Haar cascade classifier, and Hough Transform.

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CHAPTER I

INTRODUCTION

1.1 Project Background

Disability or Paralysis is a serious disease which is still becoming a biggest problem and haunts anyone, anywhere, and anytime. It is important to understand the meaning of disability, before further explanation of this system. Based on (worldnet, 2011), disability is the condition of being unable to perform as a consequence of physical or mental unfitness. The disabled persons are unable to do the task which normal persons can do. In this case, that task is controlling computer's mouse.

Imagine if this system can help those disabled people by developing software that enables them to control computer's mouse by only using ordinary computer webcam.

1.2 Problem Statement

Before describing the problem statement, it is important to understand that there are many different types of impairments which led to disabilities. Those are:

- Visual impairment
- Hearing impairment
- Physical impairment
- Cognitive or language impairment
- Seizure disorder

In this case, this project only covers the physical impairment. According to (CODI, 2011), physical impairments include paralysis (complete or partial), severe weakness, interference with control, missing limbs, and speech impairment.

Based on (World, 2008), disability affects hundreds of millions of families in developing countries. Currently around 10 % of the total world's population, or roughly 650 million people, live with a disability.

After understanding that definitions and seeing the statistic, come up some questions: “how do those people with the disabilities or paralysis operate computer?” and “How can we help the enormous number of physical impairments people in operating computer?”. These questions are describing the problem statements in this chapter.

Regarding to those questions, this project introduces “Tuffah Wajaha”, the software that allows the disabled people operates computer by controlling mouse using their head movement and eyes.

1.3 Objective

The objectives of this project are:

- Develop software that tracks the head movement in real time in order to enable the disabled people to move the mouse cursor.
- Develop software that recognizes the both eye's iris in order to do the right and left clicking actions.
- Provide the lowest cost as possible in order to make the software works with the easy and in a lowest price, by only using ordinary computer webcam.

1.4 Scope

This project, which is code named as “Tuffah Wajaha” is categorized in the image processing field, which is the subset field of Artificial Intelligence.

As mentioned in the problem statement, the project covers the physical impairments problems, which is the disability of paralyzed people in controlling the computer's mouse.

The project's target will be specialized for those paralyzed or disabled people who can't operate the computer. In this case, to have a full control of computer's mouse.

1.5 Project Significance

Tuffah Wajaha is expected to provide the solution for disabled or paralyzed people to make their dreams come true, which is operating computers as the normal peoples do.

The system allows the disabled people to have a full control of computer's mouse with the cheap hardware, which is by only using ordinary computer webcam.

By having a full control of the computer's mouse, It is not impossible for disabled people to play computer games, reading e-books, surfing internet, surfing facebook, twitter, and so on and so forth.

That is possible by using one of the image processing techniques to process the image captured by the webcam, in real time. The further explanation of how Tuffah Wajaha works will be elaborated in the next chapter.

1.6 Expected Output

This project is expected to be able to produce computer software that will help the disabled people to have a full control of the computer's mouse.

The software is called wajaha, the facial human computer interaction system which works by using cheap computer webcam.

The software is expected to become user friendly, fun, easy to use, and does not require much cost to implement.

1.7 Conclusion

Tuffah Wajaha is the software which is expected to be the first step of the solution to help disabled or paralyzed people to have full control of the computer's mouse by only using cheap ordinary computer webcam.

Finally, the introduction of this project has been elaborated, the literature review is the further process along with the project methodology to explain the algorithm of wajaha.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

In this chapter, all of the literature review will be elaborated as well as the algorithms and the project methodology used in this project.

This project uses various kinds of titles and types of references which are taken from various trusted scientific paper sources. It is done, in order to do some research about the algorithm, performance, and specification needed.

The existing systems are also elaborated in order to give a clear image about this project, the advantages and disadvantages, how it works, and how the performance is.

This project uses several kinds of techniques in order to achieve the expected output and goals. And also the project is planned in order to meet the schedule of submission.

2.2 Facts and Findings

2.2.1 Domain

Tuffah Wajaha is categorized as an artificial intelligent domain. In the more detailed area, it is in the image processing field which is the branch of artificial intelligent. In order to get the global view of the domain discussed in this project, the figure below is shown.

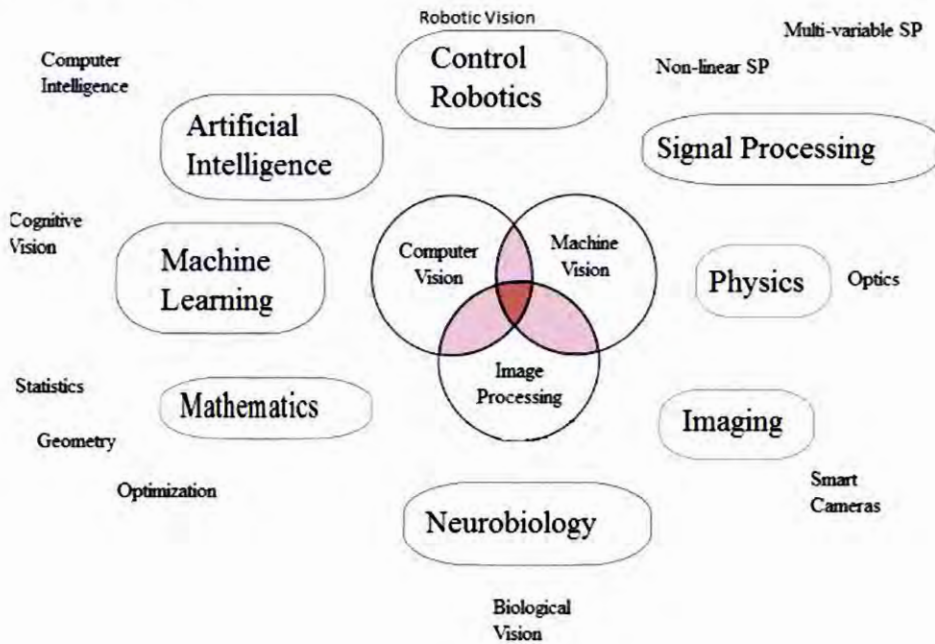


Figure 2.1: Relation between computer vision and various other fields

After understanding the figure above, it is clear that the domain in this subject is image processing which is involving the domain of artificial intelligence as well. For further explanation, the definition of the domain discussed in this project is important.

Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of

using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable (McCarthy, 2007).

Image Processing refers to processing digital images by means of a digital computer. It means that the image is processed by using digital computer in order to extract or obtain some information from it. The aims of image processing are:

- Improve the quality of images
- Enhance or extract important information from images for better
- Human understanding or machine perception
- produce special image effects

In this project, the software is tracking the head movement in real time and detects the user's iris. From the point of view of image processing, it is clear that the aim is to extract important information from images for better.

Based on (Strumiřlo, 2009), Human Computer Interaction can be described as the point of communication between the human user and a computer. The devices used for communication with the machine are keyboard, computer mouse, trackball, touch pad and touch screen.

Because in this project, getting the control of the computer's mouse is discussed, the Human Computer Interaction is also involved as well.

2.2.2 Existing System

As it has been mentioned before, this project is discussed in the domain of artificial intelligence, which is image processing. As the project's aim is to let the disabled user to control the mouse, the domain of the human computer interaction is also included.

These are several of the existing system which is related with this project. Some of them are in the form of research or educational purpose only and some of them are already in the market. Those are:

- Extraction Application of Face Feature Component (Agushinta, Karmilasari, & Tanjung, 2006)
- Facial Feature Detection Using Haar Classifier (Wilson & Fernandez, 2006)
- Eye Detection in Facial Images using Circular Hough Transform (Khairrosfaizal & Nor'aini, 2009)

The self study or self research has been conducted in order to select the suitable image processing technique used in this project. Therefore, it is founded that Hough Transform can be used to detect the iris.

According to (SHIH, 2010), Hough Transform is a technique to identify specific shapes in an image. Based on the definition, it can be used to detect the user's iris in consideration that the user's iris has a circular shape.

Previous Research has been discussed about the algorithm which is also used in this project. For example, in the readings and experiments by Rupal Khirari it uses a Circular Hough Transform to track the iris at real time (Khilari, 2010).

The hardware and software is used in the project is visual studio 2010 and for the hardware used is Genius Look 316 webcam with the following specifications:

- Image Sensor type: VGA (640 x 480) CMOS Image Sensor
- Lens type: Manual Lens
- Interface: USB1.0/1.1
- File format: BMP/AVI
- Still image: 1,280 x 960(DirectX9.0 later and software interpolation)
- 1,024 x 768(DirectX9.0 later and software interpolation)
- 800 x 600(DirectX9.0 later and software interpolation)
- 640 x 480 / 352 x 288 / 320 x 240 / 176 x 144 / 160 x 120
- AVI Capture: 640 x 480 (Maximum)
- Built-in Microphone: No
- Frame rate: (1). 320 x 240 / up to 30 frames per second (with recommended system)
- (2). 640 x 480 / up to 15fps
- TWAIN Compliant: Yes

- Windows xp,vista,7 supported

2.2.3 Technique

There are various kind of techniques used in this project. The techniques used are either from the discipline of image processing, or other technique proposed by researchers.

The first technique which is derived from image processing is Hough transform which is used to detect the eye's iris.

In accordance with (Khilari, 2010), the Iris can be accurately detected and tracked at real time using a modified form of the Hough Transform. The Circular Hough Transform (CHT) takes advantage of the fact that a human iris is circular in shape.

Based on the definition above, Hough transform is selected to be used as the algorithm to detect the iris although others algorithms are exist as well.

The reason why the others algorithms are not used in this project because at self study phase, the disadvantages of algorithms were found. For instance, in the research by (M.J, D.J, & Yacoob, 1998), it detects blink using optical flaw but the system restricts motion of the subject and needs "near frontal" views in order to be effective. The reported 65% success rate in detecting blinks seems to be too low for applications such as communicating via blinks.

The other algorithm used in this project is face feature or component localization which is described in detail in the next chapter.