

UNIVERSITI TEKNOLOGI MARA

**EMBEDDED HARDWARE
IMPLEMENTATION FOR REAL TIME
HAND GESTURE RECOGNITION**

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ABSTRACT

This research is focused in designing a low-cost embedded system which can produce robust marker-less tracking system. The application will benefit medical, disabled person and factories, since it can perform as a replacement of mouse cursor by just gesturing motion in the air. The performance of the hand gesture image recognition, segmentation technique and feature classification technique is established as part of the processes. There are four main phases were set up in achieving the research objectives. Initially, image of hand which are being captured are being segmented using Canny and Otsu threshold technique. Then, the hand image is extracted using convex hull and convexity technique while angle of fingertips is obtained from feature vector representation. Three actions are classified: MOVE, RIGHT CLICK and LEFT CLICK cursor. All these actions are then demonstrated with the Arduino board to verify that all techniques are authenticated based on the signal sent by hand gesture. An experiment is set up for 10 users for validation. Also, the users are trained to familiarize with the gesture system. The results revealed that the users are better trained in controlling their fingertips after five-minute of training in the second trial. The findings show that an increase in the LEFT CLICK action is achieved from 33.3% to 52.6%. The RIGHT CLICK is improved from 46.7% to 61% while 56.7% to 77.3 % for MOVE cursor. The results indicate that the system is capable to replace the multi-touch modalities. In addition, there are three different LED colors: RED, YELLOW and BLACK are embedded to the system to represent the gesture - MOVE, RIGHT CLICK and LEFT CLICK respectively, using serial communication. For that reason, low-cost embedded system for marker-less tracking system has been verified to obtain good gesture recognition.

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CHAPTER ONE

INTRODUCTION

People interact with technology in their daily life. Development in computer technology has lead human to progress tremendously. Human interaction with computer technology for instance, has become an essential component of their daily life. They incorporate their work with computer as nearly every second. Personal computers were introduced into working environments in early 1980s equipped with a keyboard, mouse and a panel display. However, as the time went by, computer with bulky screen display has reduced in size. Furthermore, computers can be found in shopping centers, train stations and other public environments which provide context-related information. Smart phone, a-must-have item, is rapidly evolved and mobile companies must compete vigorously to produce smart phone with latest technologies.

Various approaches of Human Computer Interface, or known as HCI have been proposed in the last few decades which act as an alternative representation of the input devices of keyboard and mouse. Recently, HCI has produced intuitive and successful interaction techniques in devices such as tablet PCs, smart phones and even smart houses.

Electronic devices such as smart phone is usually equipped with a touch screen panel, which enables users to experience human-friendly gestures. Touch screen is an electronic visual display that enables user to control multi-gestures by touching the screen with a special pen or fingers. People, who have restricted capability to perform activities, may discover that human-friendly gestures can provide some assistance. There are also few applications on PC platform which has interactive entertainments and augmented reality, however, these interactions required more natural and intuitive interface to interact adequately. For the reason, that is why natural interaction approaches between human and computer is essential and need to be consistent with the development of ubiquitous computing. Hence, brief background to the hand gesture recognition is described in the subsequent section.