DESIGN AND DEVELOPMENT OF FINGER -VEIN CAPTURE DEVICE USING ARDUINO MICROCONTROLLER

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This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is likewise dedicated to my mother, who taught me that even the largest task can be achieved if it is executed one step at a time.

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ABSTRACT

The project is focusing on design and developing a finger-vein capturing device by using Arduino Microcontroller. It is a device that will capture the human finger vein image and will be controller by Arduino Microcontroller. This is for Biometric purpose is such as authentication, verification and identification. The concept of this project is a near-infrared light (NIR) will be emitted by a bank of NIR Light Emitting Diodes (LEDs) which will penetrate the finger and are absorbed by the haemoglobin in the blood. The areas in which the NIR rays are absorbed (i.e. Veins) thus appear as dark regions in an image conveyed by a CCD camera located on the opposite side of the finger. The brightness of the NIR will be control automatically by using Arduino Microcontroller to get the clear image and suitable image. The image captured is analysed by using Mean Square Error (MSE) and Peak Signal-to-Noise Ratio (PSNR).

ABSTRAK

Projek ini adalah untuk membina satu model "Reka Bentuk dan Membangunkan Peranti Penangkap Corak Saluran Darah Jari dengan menggunakan Arduino Microcontroller". Peranti ini adalah alat yang digunakan dalam menangkap imej saluran darah jari manusia dengan menggunakan kawalan Arduino Microcontroller. Ini adalah bagi tujuan keselamatan biometric khususnya dalam pengesahan, pengiktirafaan, dan juga pengambilalihan. Konsep yang membolehkan cahaya berhampiran inframerah, *Near Infrared* (NIR) menembusi jari dan akan diserap oleh hemogoblin dalam darah tubuh badan kita. Kawasan yang sinar NIR diserap adalah saluran darah jari akan muncul sebagai kawasan gelap dalam imej ditangkap oleh camera CCD yang terletak bertentangan dengan kedudukan jari. Keterangan cahaya NIR akan dikawal secara automatik dari Arduino Microcontroller bagi mendapatkan imej yang lebih jelas dan mendapatkan imej yang sesuai. Imej yang ditangkap dianalisis dengan menggunakan Error Mean Square (MSE) dan Peak Signal-to-Noise

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LIST OF ABBRIVIATIONS

AC – Alternate Current

CCD – Charge-coupled Device

CMOS – Complementary Metal-oxide Semiconductor

DC- Direct Current

EPI – Echo Planar Imaging

FRR – False Rejection Rate FAR – False Acceptance Rate

FTE – Failure to Enrol

FKEKK – Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer

GUI – Grafical User Interface

ICSP – In Circuit Serial Programming

LED – Light Emitting Diode

MSE – Mean Square Error

NIR – Near Infrared

PWM – Pulse Width Modulation

PSNR – Peak Signal-to-Noise Ratio

USB – Universal Serial Bus

UTeM – Universiti Teknikal Malaysia Melaka

CHAPTER I

INTRODUCTION

1.1 Project introduction

This project is focusing on designing and developing a low-cost and solely standalone finger-vein capturing device controlled by the Arduino Microcontroller. This device is used for biometric security purposes such as authentication, recognition and acquisition. This device can capture image of finger-vein and the concept of capturing image produce when a near-infrared light (NIR) will be emitted from a bank of NIR Light Emitting Diodes (LEDs) which then penetrate through the finger and then absorbed by the haemoglobins in the blood. The areas in which the rays are absorbed (i.e. Veins) thus appeared as dark areas in the image. Then, the image is taken by a Charged-Couple Device (CCD) camera located on the opposite side of the finger. But the problem or the issue had been arise was that the body temperature of each person varies one another. Hence, the shadows may be created when the NIR pass through the finger. Arduino Uno microcontroller was used to control the output of the Pulse Width Modulation (PWM) from the light intensity of the NIR to suit different person's body