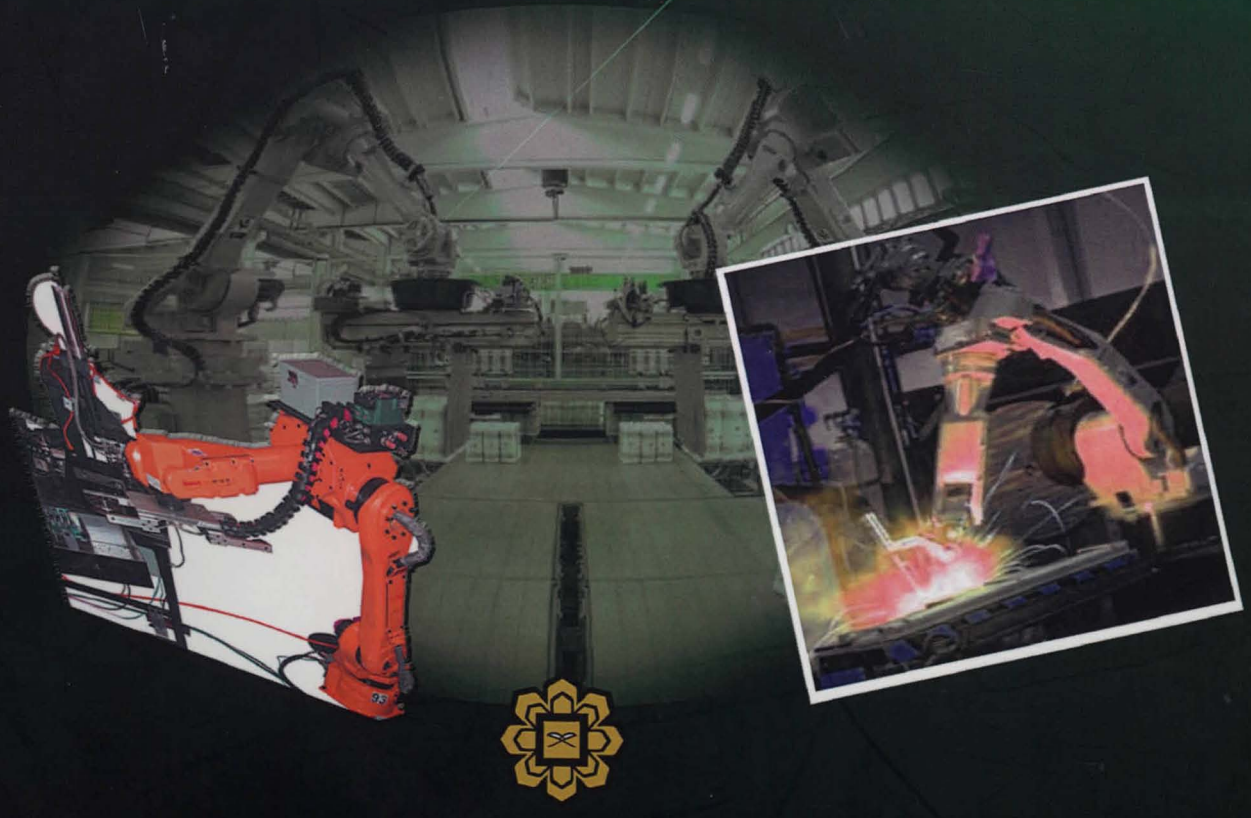
MECHATRONICS BOOK SERIES

ROBOTICS AND AUTOMATION

Rini Akmeliawati
Wahju Sediono
Nahrul Khair Alang Md. Rashid



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CHAPTER 1

Visual Tracking for Human Face

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1.1 Introduction

Human Robot Interaction (HRI) is integral for development of social able robot to ensure the achievement of affective communication between the robot and human. A humanoid robot with adromorphic construction can increase the level of interactivity whereby emotional expression can be exchanged with verbal cues and physical gestures [1-3].Some of the significant works in analyzing facial expressions are presented in [4-6].

Identification of facial expressions enables the robot to be emotionally responsive. The visual cue of the human act as the input and the robot are supposed to analyze the cues accordingly. . In this type of application, capability of detecting and tracking a human face from video sequences is necessary. But locating and tracking of human face from visual input is particularly challenging because human faces have a very high degree of variability in terms of pose, scale and important facial features.

Automation of facial expression analysis begins with the identification of a human face from a scene commonly referred to face detection or face segmentation. Accuracy of the system largely depends on the accuracy of the human face detection. Functionality of face tracking is largely dependent on the face segmentation.

Initial face segmentation techniques was only capable of detecting single frontal-face from image with simple uncluttered background using neural network, template-matching , or skin color properties [11]. Recent advancements in technology allowed researchers to attempt more computing-intensive techniques such as appearance-based or optical methods to increase the detection rate. These techniques proved to be efficient in segmenting multiple human faces even with partial occlusion and complex, cluttered background images.

Segmentation of moving faces from a video sequence requires a different approach. Face detection could be done in single frame of the video with any of the techniques applied on static image. Subsequent video frames are then compared using pixel-based changed detection procedures based of difference images. More recent methods use optical-flow techniques for detecting human face from the video. They extract the color information from the video frames to identify possible location of human face in the image-plane. These methods can also be applied for segmenting multiple faces.

This paper presents a method that utilizes Successive Mean Quantization Transform (SQMT) and the split-up Sparse Network of Winnows (SNoW) classifier [13] to detect the faces. The system is implemented on a humanoid head platform name as AMIR II where its movement is controlled by Dynamixel AX-12+ smart servo motors from Robotics. These motors have very unique characteristics, such as, 300 degree of movements in 1024 increments, 1,000,000 bps