REAL-TIME WIRELESS FACE RECOGNITION SYSTEM (RT-WiFARES)

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FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : REAL-TIME WIRELESS FACE RECOGNITION SYSTEM (RT-WiFARES)

Sesi Pengajian : 1 2 / 1 3

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For mom, dad and family

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ABSTRACT

This project is aimed to design a real – time wireless face recognition system that is using two kinds of libraries in the C++ environment that are GStreamer and OpenCV libraries. This system is going to detect a human face on a live recording video session that are using IP camera. It then will match the captured image with the database. This process happens in real-time concept which is the output response to the input is synchronous and no time delay is expected. A sample image will be used as reference in the database. It will have the detail of the reference image for example their names. Thus when an image is captured by the video recording, it then will match the captured image with the sample image that is already stored in the database. The objective of this project is to enhanced current CCTV limitation such as reduce the human intervention in the monitoring process and produce a wireless connection between the IP camera, the router and the controller (PC). Other than automatically detect a human face, this project will also enable an update to the database by creating a GUI interface. This interface will allow the inserting of new image into database if required.

ABSTRAK

Projek ini bertujuan untuk mencipta satu sistem masa nyata pengecaman wajah tanpa wayar yang berasaskan dua jenis fungsi di dalam sistem C++ iaitu GStreamer dan OpenCV. Sistem pengecaman wajah ini akan mengesan wajah manusia melalui rakaman video yang menggunakan kamera IP. Ianya kemudian akan memadankan wajah yang ditangkap dengan sistem pangkalan data. Proses ini berlaku dalam konsep masa nyata iaitu tindak balas sistem adalah berkadar terus dengan input yang dikesan dan melibatkan penggunaan masa yang pantas. Proses pengecaman wajah dilakukan dan dikawal oleh satu pangkalan data. Pangkalan data ini mengandungi sampel imej termasuklah pengenalan mengenai imej tersebut seperti nama dan sebagainya. Apabila satu imej telah dikesan oleh system, imej tersebut akan melalui proses pengecaman wajah oleh pangkalan data. Objektif bagi projek ini adalah untuk memperbaiki kekurangan yang terdapat pada system CCTV masa kini seperti mengurangkan penglibatan manusia di dalam proses pemantauan dan juga menggunakan sambungan tanpa wayar di antara alatan yang digunakan iaitu kamera IP, router dan komputer pengawalan. Selain daripada boleh mengesan wajah dengan pantas, projek ini juga akan membolehkan proses mengemaskini data dilakukan dengan mewujudkan satu paparan antaramuka pengguna. Paparan ini akan membenarkan imej baru dimasukkan ke dalam pangkalan data sekiranya diperlukan.

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MRTD	- Machine Readable Travel Documents
CCTV	- Closed Circuit Television
IP	- Internet Protocol
GUI	- Graphical User Interface
WLAN	- Wireless Local Area Network
OFDM	- Orthogonal Frequency Division Multiplexing
ISP	- Internet Service Provider
ICMP	- Internet Control Message Protocol
AVI	- Audio Video Interleave
MPEG-1/2	- Moving Picture Experts Group
MJPEG	- Motion Joint Photographic Experts Group
MP3	- MPEG-1 Audio Layer-3
DIY	- Do It Yourself
IR	- Infra Red
WEP	- Wired Equivalent Privacy
WPA	- Wi-Fi Protected Access
FTP	- File Transfer Protocol
ADPCM	- Adaptive Differential Pulse-Code Modulation
LAN	- Local Area Network
WAN	- Wide Area Network
MFC	- Microsoft Foundation Class
HCI	- Human Computer Interaction
SIFT	- Scale-Invariant Feature Transform
ASF	- Advanced System Format
FLANN	- Fast Approximate Nearest Neighbor Search Library

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

This chapter will give an overview of the project such as project introduction, project objective, project scope, project methodology and summary of this project. This chapter will explain briefly about the work from the beginning until the project is implemented.

1.1 Introduction

Face recognition is one of the most important abilities that we use in our daily lives. There are several reasons for the growing interest in automated face recognition, including rising concerns for public security, the need for identity verification for physical and logical access, and the need for face analysis and modeling techniques in multimedia data management and digital entertainment. Research in automatic face recognition started in the 1960s. Recent years have seen significant progress in this area and a number of face recognition and modeling systems have been developed and deployed. However, accurate and robust face recognition still offers a number of challenges to computer vision and pattern recognition researchers, especially under unconstrained environments. [1]

For face recognition in video, it has received significant attention during the past several years. The wide availability of powerful and low-cost desktop and embedded computing systems has created an enormous interest in automatic processing of digital images in a variety of applications including biometric authentication, surveillance, human-computer interaction and multimedia management. Research and development in automatic face recognition follow naturally.

Video is a rich source of information in that it can lead to potentially better representations by offering more views of the face. Further, the role of facial motion for face perception has been well documented. Psychophysical studies have found evidence that when both structural and dynamic information is available, humans tend to rely more on dynamics under non-optimal viewing conditions (such as low spatial resolution, harsh illumination conditions and many more). Dynamics also aids in the recognition of familiar faces. If one were to ignore temporal dependencies, a video sequence can be considered as a collection of still images so still-image-based recognition algorithms can always be applied. [2]

Face recognition has several advantages over other biometric modalities such as fingerprint and iris. Besides being natural and nonintrusive, the most important advantage of face is that it can be captured at a distance and in a covert manner. Among the six biometric attributes considered by Hietmeyer that are faced, finger, hand, voice, eye and signature, facial features scored the highest compatibility with a Machine Readable Travel Documents (MRTD) system based on a number of evaluation factors such as enrollment, renewal, machine requirements and public perception.

Face recognition technology is now significantly advanced since the time when the Eigenface method was proposed. In the constrained situations, for example where lighting, pose, standoff, facial wear, and facial expression can be controlled, automated face recognition can surpass human recognition performance, especially when the database (gallery) contains a large number of faces. However, automatic face recognition still faces many challenges when face images are acquired under unconstrained environments.

Face recognition as one of the major biometric technologies has become increasingly important owing to rapid advances in image capture devices, the availability of huge amounts of face images on the Web and increased demands for higher security. It is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. Comparing selected facial features from the image and a facial database is some of the methods in face recognition.

One of the reasons face recognition has attracted so much research attention and sustained development over the past 30 years is its great potential in numerous government and commercial applications. In 1995, Chellappa et al. listed a small number of applications of face recognition technology and described their advantages and disadvantages. However, they did not analyze any system deployed in real applications. Even the more recent review, where the set of potential applications has been grouped into five categories, did not conduct such an analysis. In 1997, at least 25 face recognition systems from 13 companies were available. Since then, the numbers of face recognition systems and commercial enterprises have greatly increased owing to the emergence of many new application areas, further improvement of the face recognition technologies, and increased affordability of the systems.

Real-time face recognition nowadays is a necessary feature in advanced surveillance systems. It is a program that guarantees a response within strict time constraints. Real-time response times are understood to be in the order of milliseconds and sometimes microseconds. Thus, in this project the response time between the captured image and the data based result is expected to be in real-time.

Real – Time Wireless Face Recognition System (RT-WiFARES) is based on WLAN camera for security purpose. The system will detect human faces and then it will match the face with the database and displays the name of the person on the video in real time. It also records the data for security purpose and can also use as an attendance system. This project will be built on GStreamer library for real time video streaming and OpenCV library for face detection and recognition system.

1.2 Project Objectives

The objective is an expectation to be achieved by a researcher. The objective of this project is to enhance the limitations in the current CCTV system. The objectives are:

1. To produce a system that require no need of human monitoring. It will be using the database system to monitor the video recording.
2. To build a system that is able to record the video session with the monitoring of database system. If a stranger is detected, the system will detect it with unknown instead of giving out the name. If necessary, the stranger can be added to the database due to the easily updated by the database.
3. To build a wireless system connection. The users can view the video output from any local or remote location and the camera can be placed anywhere within the network.
4. To implement the using of IP camera that offers great definition megapixel and higher definition images.

1.3 Problem Statement

The problem statement is a brief but concise description of the problem and tells the resistance encountered by a researcher. The problem statement is the statement made after identifying the problems and solutions to the problems are being studied. This project addresses limitations in the current CCTV system as follows:

1. Need human to monitor the video. If the system is un-monitored, it will be useless. Intruders can freely move.
2. Current system just recording it without a proper monitor system. If intruders are detected, the entire recording system must be viewed precisely.
3. The current system uses a wired connection. This means the monitoring range is limited.

4. The video quality and recording quality of the analog system of the CCTV is lesser than the digital camera.

1.4 Project Scope

The scope of the study is the area covered during the study undertaken. The project is evolving around several scopes. The scopes are:

1. WLAN connection.

The connection between the IP camera, router and PC (database) are in wireless. It gives the users the mobility to move around within a local coverage area and still be connected to the network.

2. C++ Visual Programming.

Developing C++ coding for face recognition in uncontrolled scenery with complex backgrounds (outdoor environments, airports, train/bus stations). The images collected over a period of time with different lighting conditions will be detected without a glitch in real time.

3. Image processing.

Image enhancement that refers to accentuation, or sharpening, of image features such as boundaries, or contrast to make the images more useful for display and analysis. This process does not increase the inherent information content in data. It includes gray level & contrast manipulation, noise reduction and so on.

4. Face detection.

It determines the shapes and sizes of human faces images. It detects facial features and ignores anything else, such as buildings, trees and bodies. Face detection segments the face area from the background. In the case of video, the detected faces may need to be tracked across multiple frames using a face tracking component. While face detection provides a coarse estimate of the location and scale of the face, face landmarking localizes facial. This may be accomplished by a landmarking module or face alignment module.

5. Movement detection.

The process of confirming a change in the position of the subject relative to its surroundings or the change in the surroundings relative to an object. If the object is moving, it will be will detect and recognize as human. Otherwise, the system will ignore it as background images.

1.5 Project Importance

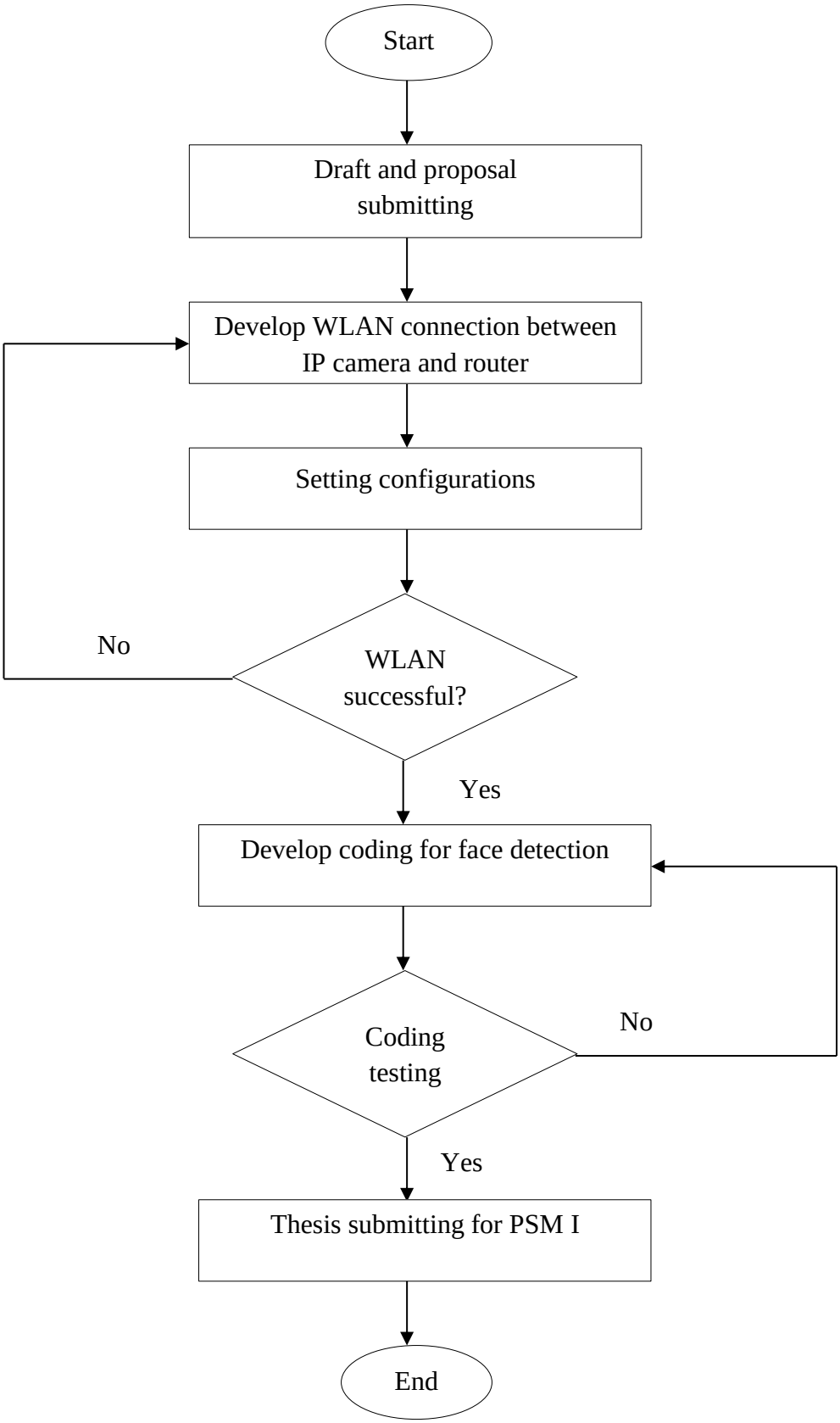
The project importance is the advantages of the project to the community. The importance are:

1. Quick in fighting crimes.
2. Reduce the human intervention in monitoring.
3. Reduce cost in hiring workers.
4. Can be used as a new concept in attendance system.

1.6 Impact of commercialization and research advancement

It can be commercialized as long as it brings more safety to the community and since it require less work, just the use of two hardware that is the IP camera and router to be implemented.

1.7 Progression Flowchart for PSM I



1.8 Progression Flowchart for PSM II