UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT DEPTH VIDEO PROCESSING USING STEREO VISION TECHNIQUE IN SPORT APPLICATION

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Telecommunications) (Hons.)

by

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **DESIGN AND ANALYZE OF APPLICATION OF OPTICAL AMPLIFIER IN SUBMARINE FIBER OPTIC CABLE COMMUNICATION LINK**

SESI PENGAJIAN: **2016/17 Semester 1**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

……

(Project Supervisor)

ABSTRAK

Pada masa kini, penggunaan penglihatan stereo di dalam industri atau sukan semakin meningkat dari satu peringkat ke satu peringkat. Visi stereo juga boleh digunakan dalam industri seperti sistem robotik, orang pengesanan dan sebagainya. Malah, penglihatan stereo juga boleh digunakan untuk membantu doktor seperti pakar bedah dan doktor gigi. Untuk kertas ini saya memilih untuk menggunakan pemprosesan mendalam video menggunakan penglihatan stereo dalam permohonan sukan seperti bola sepak, bola jaring, badminton dan lain-lain Sebagai contoh dalam bola sepak, projek ini dibina untuk membantu mereka yang mempunyai masalah dalam pengurusan bola sepak dan juga pembentukan bola sepak. Kesulitan sentiasa berlaku dalam bola sepak adalah dalam untuk menganggarkan jarak antara pemain dalam pembentukan bola sepak. Ini Tujuan projek ini adalah untuk membangunkan satu sistem penglihatan stereo untuk permohonan sukan dan menganalisis peta perbezaan dalam pengukuran jarak objek. Dalam projek ini, ia memperkenalkan salah satu aplikasi yang banyak Matlab dan sistem penglihatan juga stereo. Akhir sekali, projek ini memberi tumpuan terutamanya kepada compability daripada Matlab dengan menilai dan menganalisis video yang direkodkan pada permainan. Pertunjukan Hasil eksperimen bahawa teknik penglihatan stereo yang hampir sama seperti peta jurang, ekstrinsik, imej pembetulan dan lain-lain.

ABSTRACT

Nowadays, the using of stereo vision in industry or in sport are growing from one stage to one stage. The stereo vision also may be used in industry such as robotic system, people tracking and so on. Even, the stereo vision also may be used to help a doctor like surgeon and dentist. For this paper I choose to use a depth video processing using stereo vision in sport application such as football, netball, badminton and etc. For example in football, this project is built up to help those who have trouble in soccer management and also the formation of the football. The difficulties always occur in football is in to estimate the distance between player in football formation. This aim of this project is to develop a stereo vision system for sport application and analyse disparity map in object distance measurement. In this project, it introduce one of the many application of Matlab and also stereo vision system. Laslty, this project focuses mainly on the compability of Matlab by evaluating and analysing the video that recorded at the game. The experimental result show that the stereo vision technique matching such as disparity map, extrinsic, rectification image and etc.

DEDICATION

Alhamdulillah, praise to the Almighty Allah S.W.T

This thesis is dedicated to:

My beloved family,

My Parents,

My Supervisor,

My Lecturers

And all my friends

Thanks for their encouragement and support

ACKNOWLEDGEMENT

Alhamdulillah, thank you Allah of His blessing, I finally complete and finish my final year project successfully.

During the process to complete my project objective, I do a lot of researched either by using internet, reading past year thesis, reference books and journal. With the guidance and support from peoples around me, I finally complete the project due to the time given. Here, I want to give credit to those who helped me to achieve what I had achieved in my final year project.

First and foremost, I would like to express my deepest gratitude to Ahmad Fauzan Bin Kadmin for giving me an opportunity working, kind, encouragement and suggestion under him supervision throughout this project. Without his continued support and interest, the project would not be like what it likes look today. May Allah bless and reward him for his sincere, endeavour and contribution in the way of knowledge.

Special thanks to my peers, my friends to had been providing me remarkable ideas to improve the project. I also want to thanks to my beloved parents because without them, I will not be able to do well in my final year project. They did give me a lot of support, both from money and moral support to help me continue for what I had started on. May Allah bless and reward them for their sincere, endeavour and contribution in the way of knowledge.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

SAD	-	Sum of absolute differences
3D	-	Three dimension
2D	-	Two dimension
CCD camera	-	charge coupled device camera
FPGA	-	field-programmable gate array
FIFO	-	First in – first out
DDR memories	-	Double data rate memories
SIFT	-	Scale-invariant feature transform
ZSAD	-	Zero-mean sum of absolute differences
ZSSD	-	Zero-mean sum of squared differences
ZNCC	-	Zero-mean normalized cross-correlation
RGB		Grayscale Image (Red Green Blue)
SURF		Speed-Up Robust Features algorithm

CHAPTER 1
INTRODUCTION

1.0 Introduction

This section focused on preparing the entire report content including the graphical illustration which can be found in appendices. This chapter focuses on the project introduction, background, problem statement, objectives and project scope regarding the project. The development of depth video processing using stereo vision technique in sport application will be explain more in detail. The problem statement states the reason why this project is being directed. At the point, toward the end of the section the association of the proposal will be clarify.

1.1 Project Background

Stereo vision is a computationally costly process that breaking point exact ongoing execution. However, this is more often than not because of substantial resolutions in top of the line cameras. At the point when ease web cameras are traded for high determination cameras, a viable constant stereo framework can accomplish ongoing execution. The accuracy of the difference of depth disparity information depends on the stereo camera adjustment and correction. For the most part in stereo vision framework the two cameras are essential. It means, these camera ought to have a similar trademark. The selection will depend on the same size of pixel and manufacturer.

Stereo vision is well suited to applications that require locating objects or obstacles, and this location data can be used to guide the movement of a robot or robotic arm. For navigating auto-nomous vehicles, depth information is used to measure the size and distance of obstacles for accurate path planning and obstacle avoidance. Stereovision systems can provide a rich set of 3D information for navigation applications, and can perform well even in changing light conditions.

A stereo vision system is also useful in robotic industrial automation of tasks such as bin-picking or depalletization. A bin-picking application requires a robot arm to pick a specific object from a container that holds several different kinds of parts. A stereovision system can provide an inexpensive way to obtain 3D information and determine which parts are free to be grasped. It can also provide precise locations for individual products in a crate.

For this project, a stereo vision system have been developed in sport application. Most popular now, the famous one sport in Malaysian are football and badminton. So, for this project it was apply in UTeM sport such Sukan Antara Fakulti (SAF). In this project, it was chosen a netball sport to apply in stereo vision technique. Besides that, this application can be applied to the others sport.

In this project, the stereo vision are being applied in the sport application using stereo camera 'ZED'. It also can detect player between player distances from camera. Based on the received measurement, it can helps people especially a coach or manager to build up their team formation and a strategy.

1.2 Problem Statement

Nowadays, the usage of stereo vision system in industry or in sport are growing from one stage to one stage. The stereo vision are most used in industry such as robotic system, people tracking and so on. Even, the stereo vision also may be used to help a doctor like surgeon and dentist. For this paper, a stereo vision sport application for especially in netball are being chosen. This is because netball one of the popular sport that everyone known. This is because the movement of game in netball are softener movement than other sport. Besides that, the often problem that occurs in netball is the difficulties to estimate the player between player distance in formation.

The other problem that can be happen is the dissatisfaction of team/coach and tactical/strategy in game. This project, will helps player to measure difficult estimation in sport. The solution is a device are used to estimate the distance between players will be developed. In addition, there are the problem of out positioning in netball. With this stereo camera or stereo vision system it can alert the player that they are out of position.

1.3 Objective

The project is implemented in order to achieve the following objectives which are:

a) To develop a stereo vision system for sport application
b) To analyses disparity map in object distance measurement

1.4 Project Scope

The scope of this project is to study the basic of stereo vision system from several publishes papers and books and also internet as well as to study the coding used to analyze the images and estimate the distance of the capture image from stereo camera. This project focus mainly on how to apply what that have been learn about the stereo vision, Matlab algorithm and an application.

For this project, it will take place in a university place. It only involve in study literature, design, coding in Matlab and hardware. This project will only focus on the process of stereo vision is usually defined as finding a match between features in left and right images. It also design the stereo vision system with filter system. On this project, it also reconstruct 2D-3D images and other matching algorithm and also measure the distance.

1.5 Project Methodology

In this project, there are several procedures that must be followed. Initially, information about stereo vision system and also measurement distance using stereo vision system technology are identified. Then, more information about the stereo vision system is gathered from the journals, internet and also articles. Next, the researches continues with the search on the basic concept of stereo vision and also find a coding about to estimate the distance and also calibrate the image.

After completing the report of chapter 1, 2, 3 this project will continue to on how to design/modelling the stereo camera that will set up in field that focused on soccer field and implement the image into Matlab coding to estimate the distance between players. Next, to get a set of images it will start to evaluate the error between the images of left and right. If the images are not converge each other, then the system will adjust the value of the camera evaluation until they converge. The value of parameter will be used as result on this project. The result of this project is the distance estimation between the players.

1.6 Thesis Structure

Chapter 1:

The first chapter introduce brief idea of the project. It focused on the overview of the project, detailing the objectives, the problems statement, scope and outcome of the project.

Chapter 2:

Project background is discussed in this chapter. It only concentrated on the literature review that described all the information that was referred as a reference in order to finish up the project. Basically literature review will contain the facts or other aspect that we need that correspond to the project that will be built. This chapter also defined terms used in this project and discussed the concept of the research and how it is related to the theory.

Chapter 3:

Chapter 3 described the methodology used in this project. The schedule and methodology that needed to be completed and the detailed reports of studies that were done to achieve the aim of the project are presented. The methodology is the important aspect as it is the beginning process of planning. If the methodology are not organized, only then will encountered the problem in the project.

Chapter 4:

This chapter is about the result and discussion. All the simulation, data collection and analysis obtained will be discussed in detail. The results will be compared with the objectives outlined in order to arrive to some hypothesis and conclusion.

Chapter 5:

Chapter 5 after through all the process and successful to achieve the objectives as stated in the earlier chapter. The project can be concluded and explain the detail in this chapter. Other than that, a future recommendation includes improving this project for the future improvement and upgrade.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter presents literature review on the development of depth video processing using stereo vision technique in sport application. The development of the different depth video processing using stereo vision technique in sport application that aim to help people to know the measurement or distance between players. The advantages and disadvantages of each stereo vision technique are also presented and compared. This chapter also presents the development of stereo vision technique system that will be utilized in this project.

2.1 Stereo Vision System

Stereo vision technology is the extraction of 3D information from digital images, such as obtained by a CCD camera. By comparing information about scene from two vantage points, 3D information can be extracted by examination of the relative positions of objects in the two panels. Human being with two eyes that work together have stereovision. Human being generally come equipped with two eyes and one head.

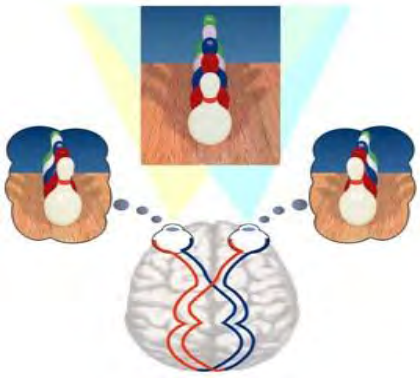

Figure 2.1:Binocular Vision

Both eye capture its own view and the two separate images are sent on to the brain processing. When the two images arrive simultaneously in the back of the brain, they are united into one picture. The mind combines the two images by matching up the similarities and adding in the small differences. The small differences between the two images add up to a big difference in the final picture. The combined image is more than the sum of its parts. It is a three-dimensional stereo picture.

Here are a few examples of application that depend on stereo vision:

- Baseball player
- Architect
- Dentist
- Surgeon

2.2 Stereo Vision Development

Jiechun Chen and Liping Zhao (2010) has develop a stereo vision based attitude measurement system for aircraft model in wind tunnel. This paper investigate a stereo vision-based attitude measurement system for aircraft model in wind tunnel. To measure the attitude of an aircraft model, a cooperative object mounted on the aircraft model is firstly used to generate two bidirectional collimated laser beam, and then the laser beam are projected onto the surfaces of two screens. A pair of binocular stereo vision measurement system is used to measure the 3D coordinates of the laser spots on the wall surfaces. Once the 3D coordinates of the laser spots are measured accurately, the attitude of the aircraft model in wind tunnel can be determined. The