DESIGN AND DEVELOPMENT OF FACE DETECTION SYSTEM FOR AUTO LIFTER ROSTRUM

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" I hereby declare that I have read through this report entitle **"Design and Development of Face Detection System for Auto Lifter Rostrum**" and found that it has comply the partial fulfilment for awarding the degree of Bachelor of Mechatronics Engineering"

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A report submitted in partial fulfilment of the requirements for the

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"I declare that this report entitle" **Design and Development of Face Detection System for Auto Lifter Rostrum** "is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree"

Mechatronics Engineering"

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ABSTRACT

The innovation on the many daily products is an on-going process and is never going to end as long as there are demands for better and more efficient method of doing something. This project focuses on a particular innovation of the rostrum which is the height adjustment. Rostrum is a rigid body furniture that are used for speakers to place important documents during speeches. The study intends to produce an automated height adjustment with face detection system for the rostrum so that different body statures of speakers could be adjust accordingly. Studies have been made on previous rostrum designs and the height adjustable mechanisms that were apply in the rostrum designs. The height adjustments in the rostrum designs are usually manually-controlled which requires a person to pre-set the height or manually adjust it. From the references, few conceptual designs are generated and selected. The fabrication of the project takes place to create the desired automated height adjustment mechanism. The face detection system is mainly used for the height adjustment of the rostrum. As per the analysis showing, the average accuracy of face detection system is from 97.95% to 99.57%, this was the average result which gained from the analysis of face detection system accuracy. Speed of the motor which used for this rostrum was calculated by repeating the height test for different people and the time taken to adjust the height, from the result gain, the speed of the motor which used for the rostrum is 0.0194 m/s. the result showing the system able to adjust the height by detecting speaker's face accurately and reliable. In a nutshell auto lifter rostrum with face detection system will be the smart system in future for speaker who will be using rostrum. The project hopes to provide better comfort and efficiency when the speaker is giving his or her speech.

ABSTRAK

Inovasi pada banyak produk harian adalah proses yang berterusan dan tidak akan berakhir selagi ada tuntutan untuk kaedah yang lebih baik dan lebih cekap melakukan sesuatu. Projek ini memberi tumpuan kepada inovasi tertentu rostrum yang merupakan pelarasan ketinggian. Rostrum adalah perabot badan yang tegar yang digunakan untuk penceramah untuk meletakkan dokumen penting semasa ucapan. Kajian ini bertujuan untuk menghasilkan pelarasan ketinggian automatik dengan sistem pengesanan muka untuk rostrum supaya statur badan yang berbeza dari pembesar suara dapat disesuaikan dengan sewajarnya. Kajian telah dibuat pada reka bentuk rostrum sebelumnya dan mekanisme laras ketinggian yang digunakan dalam reka bentuk rostrum. Pelarasan ketinggian dalam reka bentuk rostrum biasanya dikawal secara manual yang memerlukan seseorang untuk menetapkan ketinggian atau menyesuaikannya secara manual. Daripada rujukan, beberapa reka bentuk konseptual dihasilkan dan dipilih. Pembuatan projek ini dibuat untuk mewujudkan mekanisme penyelarasan ketinggian automatik yang diinginkan. Seperti yang ditunjukkan dalam analisis, ketepatan purata sistem pengesanan muka adalah dari 97.95% hingga 99.57%, ini adalah hasil purata yang diperoleh daripada analisis ketepatan sistem pengesanan muka. Kelajuan motor yang digunakan untuk rostrum ini dikira dengan mengulangi ujian ketinggian untuk orang yang berlainan dan masa yang diambil untuk menyesuaikan ketinggian, dari keuntungan hasil, kelajuan motor yang digunakan untuk rostrum ialah 0.0194 m / s. Hasilnya menunjukkan system ini dapat menyesuaikan ketinggian dengan mengesan wajah pembicara dengan tepat dan boleh dipercayai. Secara ringkasnya alat pengangkat gerudi auto dengan sistem pengesanan muka akan menjadi sistem pintar di masa depan untuk pembicara yang akan menggunakan rostrum. Projek ini berharap dapat memberikan keselesaan dan kecekapan yang lebih baik apabila pembicara memberi ucapannya.

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γ = Wavelength

C = Speed Of The Light

E = Energy

F = Frequency

H = Planck's Constant

Td = Driving torque (Newton. meter)

P = Load (Newton)

L = Lead of screw (meter/revolution)

e = Ball bearing screw efficiency (approximately 0.9 for ball screw, 0.4 for acme screw with plastic nuts, and 0.25 for acme screw with bronze nuts)

W = Angular velocity

n = Number of teeth

d = Diameter

Bs = Model Pixel At Background S

D = Distance

Is,T = Made Of Static Background

Xt(S) = Motion Level Field At Time

T = Threshold

LIST OF ABBREVIATIONS

CNN = Convolutional Neural Network

SVM = Support Vector Machine

ROI = Region of Interest

HOG = Histogram Oriented Gradient

DPM = Deformable Part Model (DPM)

TP = True Positive

TN = True Negative

FP = False Positive

FN = False Negative

CHAPTER 1

INTRODUCTION

This chapter provides an introduction on the project entitled, “Design and Development of Face Detection System for Automatic Lifter Rostrum”. Rostrum is a rigid column body furniture that provides a space for the speakers to put their notes and other speech material during a speech. The chapter include covered the background of the project, motivation of the project, problem statement, objectives and scope. In depth discussion on the project will be highlighted in later chapters.

1.1 Project Background

Historically, rostrum is a platform used by the speakers inside the Roman forum for public orators, and it becomes typically adorned with the prows of captured enemy ships. Nowadays, the time period rostrum refers to wooden fixtures with a base joint with a vertical column up to the desk in which the crucial files are positioned and the microphone is typically placed (Figure 1.1). Enhancing in living requirements and the search of recent creative and innovative technology calls for better characteristic of this product. On this remember, the values for ergonomic is brought to improve the factors of the podium and one of the most important concept may be carried out is to have an automatic peak adjustable mechanism, which suits special users characteristics.

Figure 1.1 Rostrum

There are many flaws of the rostrum inside the market nowadays may be taken into consideration when doing research. The fundamental troubles that befell inside the contemporary rostrum layout are heavy and hard to move, majority rostrum has a fixed peak, manually adjustable top of microphone, no pointer on rostrum for presentation, majority rostrum does now not have display for text/speech, microphone doesn't observe personal motion, there's no wheels at the lower part of rostrum for clean transportation as the list in [1][2].

The first trouble is the rostrum is difficult or solid in accordance with transit fit according to the rostrum forlorn no wheels. Ordinary rostrums generally committed beside wood then wood products namely a strong part over furnishings capable concerning adjusted barring anybody extra support. But the trouble is as the rostrum turns into also heavy. So by way of existence severe and no longer grudging any wheels, that creates a problem because shifting the rostrum. More manpower pleasure remain wanted according to transit the rostrum.

Normally rostrum inside the marketplace doesn't have screen display that makes it less difficult for the speaker to talk without having to peer his or her notes. Usually, speakers use cue cards to supply speeches in a greater prepare manner. Every so often the speakers can wander off within the cue card looking for his or her notes [3]. This

may create panic and growth level fright inside the speaker. This will destroy the speech. Rostrum with display ought to remedy the problem.

Presently in the market, majority rostrum does not have a pointer for presentation functions. The trouble creates while an extra man or woman is wanted to navigate the slides. This is an instance of crucial feature as it could be used for more than one displays even for paper presentation.

Usually, the modern rostrum is manually adjusted and for the grasp of rite his or her want to manually regulate the rostrum after every speaker. There is much other trouble whilst the speaker movements to and from but the microphones stays constant. No remarks happens causes the microphone to be regular. This affect the voice projection of the speaker to be disturbed which limits the movement of the speaker.

Often, at lectures or speeches there may be some of human beings with a view to supply the lecture or speech to the listening audience and in the event that there is a special in frame stature in peak of the speakers, the podium may be without difficulty adjusted to suit the precise speaker at any individual time. The want of this specific technology in the rostrum may be studied can achieved within the challenge. Height adjustment generation in rostrum isn't always something new and because of that the examine will awareness on an innovative idea of creating the mechanism computerized.

1.2 Project Motivation

Rostrum is a platform or a reading desk with a slanted top that used for public orators, a stage for public speaking, usually placed on a stand or affixed to some other forms of support on which documents or books are placed as support for reading aloud or lecture. Rostrum is also called as lectern that been used by speakers, lecturers or leaders to convey messages, to give lecture and speech, to speak formally to a crowd.

Nowadays, the rostrum is use for formal ceremonies such as meetings, award ceremonies, political events and others. Rostrum is always must in any speaking venue and it is also an effective way to give out information. Rostrum tends to attract attention from the audiences or crowd. People would listen to the speaker once the speaker is on the podium. It is a best way to attract attention of peoples.

1.3 Problem Statement

The rostrum is a furniture frequently used by a speaker to place the objects including reviews, speech notes, laptop and others for the reason of assisting the progress of the speech. Historically, rostrum is constructed with a selected material from top to bottom and in different heights.

Consequently, extraordinary speakers sometimes while giving speech could need to alter themselves which will be as relaxed as viable in turning in their speech. In lengthy speeches or long lectures, this will create difficulties and pain to the speaker and a lengthen exposure could create a fitness associated problem [1]. For example, a speaker who are too tall for the lectern will face difficult and not comfortable to deliver the speech whereas a speaker that is too short will need to strain on their self to reach the microphone in lectern and the lectern may also may not be comfortable for the speaker.

A rostrum with the maximum fundamental fee could have a height adjustable mechanism which permits appropriate range of height options to be performed. This may let the speech or lecture to be easily deliver to audience who are listening without the need to fear approximately backache or any fitness associated hassle [2]. By accomplishing this lectern, the fee of the rostrum may be the focusing factor for improvement. The important fact, that the rostrum is aesthetically fascinating because the target audience attention may be centred on the rostrum and the speaker while the speech or lecture is being brought.

1.4 Project Objective

The objectives of this project are:

i. To design an automatic lifting rostrum with face detection method.
ii. To develop the automation system of rostrum by using face detection system.
iii. To analyse the efficiency of the automated rostrum with face detection system.

1.5 Project Scope

The scopes of this project are:

i. Cover the studies on the principle of image processing.
ii. Raspberry Pi is used for face detection and Arduino used as a controller to develop a program which to control the movement of the motor.
iii. The proposed design is only suitable for average sized human (170cm – 195cm) from around the world.
iv. Limitation of height of the rostrum is minimum (103 cm) and maximum (133 cm)
v. The limitation of the user is just one person at time.

1.6 Thesis Outline

This thesis consists of 5 main chapters. Firstly, the title of the project was confirmed at the initial stage. This thesis starts with the chapter 1 that is an introduction. The first chapter discussed the overview of the project background, motivation, problem statement, objective, scope, and the expected outcome of the project. Then this thesis is continued with the second chapter literature review. Chapter 2 discussed literature review that is related to this project based articles, journal, books, and internet. In this particular chapter, it is discussed briefly the fact, technique components and materials used from the previous studies. Next in chapter 3 is the methodology described the planning of design structure, methods going to use,

procedures of experiment going to be done throughout the project and controller such as Arduino. Chapter 4 discussed the results and analysis with construct a table. The results obtained from the project will be analysed in this chapter. Finally, chapter 5 is discussed the project achievement and future recommendation.

CHAPTER 2

LITERITURE REVIEW

2.1 Introduction

This chapter provides the literatures and facts associated with the automated peak adjustable rostrum. The reason of this chapter is to check the important and fundamental idea, layout and manufacturability of the proposed product. In this chapter, topics which might be of significance to the challenge are highlighted including sensors, mechanisms, materials and designs.

2.2 Rostrum

Consistent with the Concise Oxford English Dictionary (11th version), a rostrum is defined as a raised platform on which someone stands to make a public speech, play track or conduct an orchestra. Rostrum is a vertical stand used for containing critical documents at the pinnacle whilst a speech is being brought (Figure 2.1). Beyond protecting notes, rostrum provides a leaning surface for speaker and provides a safety barrier among the speaker and the audience. It gives the location for the speaker to prepare the materials related to the speech and once in a while to expand the voice of the speaker via a microphone.