UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF VISION-BASED LUGGAGE BAG FOLLOWING SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Kajian ini dibuat bagi mencadangkan satu masalah dimana terdapat satu kesukaran di suatu tempat paling sesak iaitu di lapangan terbang. Satu masalah telah dikenalpasti dimana terdapat pengguna yang menggunakan bagasi sukar untuk membawa bagasi tersebut kemana sahaja pengguna itu pergi. Sebagai contoh pada para ibu bapa yang membawa ramai anaknya menjadi masalah apabila hendak membawa bagasi sambil menjaga anak-anaknya dan juga untuk para (OKU). Jadi satu kaedah dan pelaksanaan untuk mengautomasikan bagasi tersebut telah dilaksanakan bagi memudahkan mereka. Kajian ini akan membangnkan system bagasi yang boleh bergerak dengan sendiri sambil mengikut tuannya yang mana boleh mengurangkan aktiviti mengheret bagasi tersebut. Komponen utama bagi membangunkan projek ini adalah seperti camera pixy yang menghubungkan secara tanpa wayar di antara pengguna dan juga bagasi. Kajian telah dilakukan untuk mengetahui fungsi dan juga keupayaan camera pixy tersebut. Pengguna hendaklah memegang isyarat dimana ia merupakan kod berwarna untuk camera pixy mengesannya untuk mengikut kod berwarna itu. Ciri-ciri keselamatan juga telah dibuat menggelakkan sebarang kejadian yang tidak diingini berlaku ditempat yang sesak itu seperti mengelak halangan dan juga mengelakkan kecurian berlaku.

ABSTRACT

This research is made to suggest a problem where there is a difficulty in the most crowded place such as at the airport. There is a problem that has been identified where there are users who use the luggage difficult to carry the luggage anywhere the user goes. For example, parents who bring their children to push the stroller and drag the luggage at the same time while taking care of their children and also for the OKU. So, a method and implementation to automate the luggage has been implemented to facilitate them. This research will build a luggage system that can move itself which can reduce the activity of dragging the luggage. The main component of developing this project is like pixy camera that can connecting wirelessly between users and luggage. The research has been done to determine the function and capability of the pixy camera. The user must hold the colour code as a signal to pixy camera detect and locate it to make the luggage follow the colour code. Safety features have also been made to avoiding any undesirable events occurring in crowded place such as avoiding obstacles and avoid from being stolen and lost.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
1	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flow-rate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle
v	-	voltage

CHAPTER 1

INTRODUCTION

1.1 Introduction

This beginning chapter will explain about the project background, problem statement, scope, objectives with regard to this project.

1.2 Background

Automation is the use of machines, control systems and IT (information technologies) to optimize productivity in service production and delivery (Tilman, 2017). Technology advancement has made robot more useful in providing human comfort. The human-robot interaction provides the robot ability to assist people in different situations, such as carrying loads that people working in hospitals, airports, and other hauling activities require. Passengers at the airport need to carry their own luggage from the airport entrance to check-in at the airport using conventional luggage carrying system. The conventional system for carrying luggage is time consuming as well as energy consuming. The proposed vision-based luggage bag follower system can provide the features necessary to overcome the above-mentioned problems.

This vision-based follower system for luggage bags is a carry-on robotics suitcase that stays at all times with its owner. With Pixy camera being implemented as the luggage's 'eyes', it will detect the owner colour code tag and be able to follow the owner who frees their hands and makes traveling more enjoyable. Manual or autonomous mode can be selected by the user. This suitcase can detect obstacles using an ultrasonic

sensor and stay in the eyesight of a traveller when on the move. The luggage also has an anti-theft alarm to prevent the loss of luggage. Also, one of the features on this luggage is a digital led lighting to indicate the level of the luggage suitcase battery.

Figure 1. 1: Luggage Bag Following System

1.3 Problem Statement

As every regular traveller knows, it can be a true problem to travel around or hauling a passport, carry-on baggage/luggage and backpack while navigating an airport. If the traveller in question has any physical health problem which are (OKU), such as using a wheel chair or walking stick, the situations gets a real hassle and worse. It can also be difficult for the mother who is bringing her child and kids to push the stroller and simultaneously carry the luggage. Usually, there must be have a lot of luggage for a family to carry. It can be a challenge situation to manage children or handle their kids and carry so many stuffs. So, this luggage bag follower system is one of the solutions that makes it

easier for travellers to take and carry their luggage out there and can also have some feature to prevent losing or stolen their luggage.

Figure 1. 2: Carry Luggage at The Airport

1.4 Objectives

The objectives of this project consist of three main aims which are:

1. To develop an automated luggage bag system in order to ease traveller.
2. To study the Pixy camera and PID system that control wheel movement based on colour codes.
3. To analyse the performance and efficiency of the proposed system.

1.5 Scope

This project's scope was restricted in its securities fields. Once the colour code cannot detect by the luggage, it will activate the sound of buzzer. GPS cannot be implemented in this project because it may have problem to detect the bag since GPS had

poor signal when it inside the building. So, it will be not efficient to track the lost luggage. Sound of buzzer will be used to notify user that his/her luggage are away from them and they should go towards the luggage. No additional battery or separate switch will be use if the theft decided to turn off the alarm after it sound up. Hence, buzzer can help to avoid the luggage from being lost. This luggage cannot follow its owner while in dark environment.

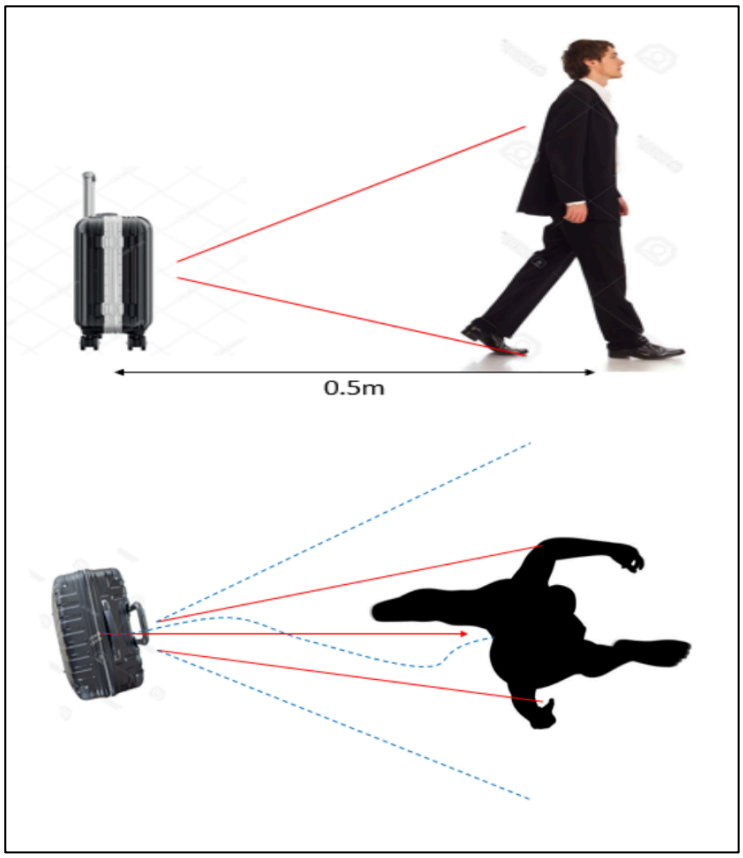

Figure 1. 3: Limitation Between Luggage and User

1.6 Report Outline

This report contains five chapters that literally discussing concept of development of this vision-based luggage bag follower system. The explanation of each chapter will be in paragraph as follow:

1. Chapter 1 will cover the introduction, study background, problem statement, objectives and scope project. This chapter described basic information about the whole project.
2. Chapter 2 will discuss on literature review which comparing previous project and research that relates to this project. This chapter also discussing about the hardware and software part that involve in this project.
3. Chapter 3 represents all the methods or ways on how the project is being implemented. The chapter holds most of the project's Vison-Based Luggage Bag Follower System and information of its development.
4. Chapter 4 representation of data and result are documented in this chapter. The results are necessary for further researches in the future.
5. This chapter 5 consists of the recommendation and conclusions which states whether the objectives are achieved or not.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The idea of implementing a human tracking robot with less complexity and creating a minimum viable product is influenced by this research. This project uses a Pixy camera to track the person's position in a practical disturbing environmental that simplifies the tracking process and can follow the user. Detection of obstacles is an added feature that allows the luggage to stop and notify the user that the luggage has been stolen or lost behind the user is by buzzer sound anti-theft alarm.

2.2 Previous Research

The first project that had been review with title is Vision-based Control of a Home Companion Robot by (Mohamad and Zhu, 2016) has been developed a robot with image processing sensor by using Pixy Camera to make a decision accordingly and can identify the colours. The aim of this previous research is to design and test a home companion robot that can interact with people who hold the transmitter to allow Pixy Camera to track in as a receiver in a natural way around the house to provide elderly companionship and help with daily activities.

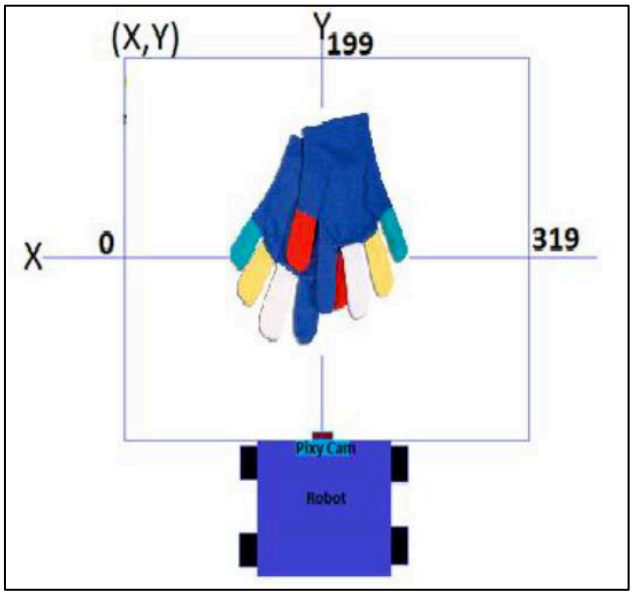

Figure 2. 1: Robot Controlled by Colour Code Glove

Based on Figure 2.1, the robot was controlled by the colour code at the glove which is consists of three different colours signature; red, yellow and green. Before to use the robot, robot must be calibrated first the colour code given and the Pixy Camera must be train to recognize each colour so that each colour will direct with different command. So red colour was assigned to signature 1 which the command for robot to turn left. Yellow was signature 2 which the command for robot to go forward. And the last signature was green which the command for robot to turn right.

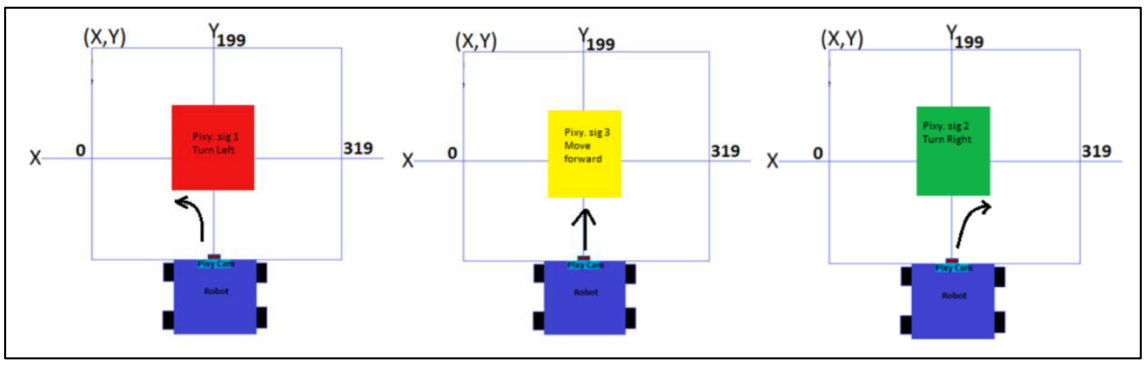

Figure 2. 2: Robot Responding to Three Different Colour Code

Based on (Mohamad and Zhu, 2016), the algorithm was created based on position of object on Y-axis and X-axis at the Figure above. The pixy Camera is used the hue-based algorithm to identify where the position of the colour instead of the size of the object also width and height of that object. This project was proven that the Pixy Camera was the only one of reliable image sensor to create the project of to make the robot follow human by through colour tracking.

The second previous project that had been through is Object Tracking Through the Use of Colour Hue Image Processing by (Sabey, 2015) with aim or goal of to develop an autonomous vehicle that use dedicated image processing system for as well as small model RC in order to tracking objects for industries purpose. The approach method in this project in order to optimize the system are by using Pixy Camera. This paper can relate to actual project that want to create and understanding the functionality of the tracking object by through colour detection. This project was using MATLAB script to develop in order to emulate the camera function and the method to track the colour. The MATLAB script was tested in order to check the reliable of the Pixy Camera and check the capability of multiple object colour detection in still-frame and single object tracking in multiple-frame and processing. The processor can communicate with camera in several different ways, but in this application only analog communication will be chosen out of different ways. The centre of the largest object that camera reports the x-axis location is being tracked. Then the location will translate to an analog voltage from 0V-3.3V. When this value voltage has been received by the processor, directional can be made to follow the object due to how much value voltage received.