UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DEVELOPMENT OF A SEMI-AUTONOMOUS AERIAL ROBOT FOR TRANSPORTATION AND DEPLOYMENT OF EMERGENCY SUPPLY FOR SEARCH AND RESCUE VICTIMS

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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Sesi Pengajian: 2019

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I hereby, declared this report entitled DEVELOPMENT OF A SEMI-AUTONOMOUS AERIAL ROBOT FOR TRANSPORTATION AND DEPLOYMENT OF EMERGENCY SUPPLY FOR SEARCH AND RESCUE VICTIMS is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing 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

Apabila bencana berlaku, mangsa terpaksa diasingkan dari bandar dan keselamatan kawasan. Oleh itu, mangsa terdampar di bangunan tinggalan atau kubu. Selepas bencana itu, biasanya, yang (SAR) misi mencari dan menyelamat akan dijalankan untuk mencari dan menyelamatkan mangsa. Walaupun tindakan pantas diambil tetapi adanya kenderaan untuk menyelamatkan semua mangsa tidak mencukupi. Oleh itu, yang mempunyai UAV autonomi sangat membantu untuk mengurangkan masa yang diambil untuk mencari mangsa. Bersama-sama dengan penglihatan mesin rangkaian neural konvolusi untuk mengenalpasti manusia, UAV autonomi mampu untuk bergerak di sekitar kawasan bencana dengan gerakan cepat dan dapat menyediakan bekalan kecemasan kepada mangsa yang terkandas di kawasan itu. Dalam kertas ini, kami akan menganalisis jumlah muatan yang UAV autonomi mampu untuk mengangkut dengan menukar diameter dan padang kipas untuk lebih memahami teras yang boleh disediakan. Penggunaan semasa juga menganalisis untuk lebih memahami penggunaan arus apabila diameter atau pic UAV autonomi berubah. Selain itu, kertas kerja ini juga membincangkan faktor-faktor yang akan memberi kesan kepada ketepatan algoritma pengesanan manusia dengan membandingkan dua kaedah pengesanan utama, terutamanya Haar Cascade Classifier dan Tensorflows API Object Detection.

ABSTRACT

When a disaster strikes, victims are forced to be isolated from the city and safety regions. As such, victims are stranded on leftover building or bunkers. After the disaster, usually, a search and rescue (SAR) mission will be conducted to locate and rescue the victims. Even though quick action is taken but the availability of vehicle to save all the victim is not enough. Therefore, having an autonomous UAV greatly helps to reduce the time taken to find a victim. Together with a convolutional neural network machine vision to identify humans, the autonomous UAV is able to move around a disastrous area with quick movement and able to provide emergency supplies to victim that are stranded in the area.

In this paper, we will be analyzing the total amount of payload a autonomous UAV is able to transport by changing the diameter and pitch of the propeller to better understand the thrust that can be provided. The current consumption also is analyzing to better understand the consumption of the current when the diameter or the pitch of the autonomous UAV is changed. Besides that, this paper also discusses the factors that will affect the accuracy of the human detection algorithm by comparing two main detection method, mainly Haar Cascade Classifier and TensorFlow Object Detection API.

DEDICATION

To my beloved parents, thank you for being with me when I was having stressful moment during the implementation of the project. My deepest appreciation and gratitude toward both my father and mother for providing financial aid during the breakdown of material during the project, without their help it would be impossible for the project to be that successful.

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Last but not least, I would like to express my gratitude to the lecturers and lab assistance that spend their time with me during testing in the labs

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LIST OF SYMBOLS

mm	-	Millimetre
Kv	-	Motor Velocity Constant
GHz	-	Gigahertz
GB	-	Gigabyte
µs	-	Microsecond
°	-	Degree

LIST OF ABBREVIATIONS

API	-	Application Programming Interface
APM	-	Ardupilot Mega
ARM	-	Advanced Risc Machines
CIFER	-	Comprehensive Identification from Frequency Responses
CV	-	Computer Vision
DOF	-	Degree of Freedom
FPV	-	First-Person View
GPS	-	Global Positioning System
GUI	-	Graphical User Interface
HSV	-	Hue, Saturation, Lightness
IDE	-	Integrated Development Environment
IMU	-	Inertial Measurement Unit
LI POLY	-	Lithium Polymer
LIDAR	-	Light Detection and Ranging
LQR	-	Linear-Quadratic Regulator
MUFR	-	Micro-Flying Robot
NCC	-	Normalized Cross Correlation
OS	-	Operating System
PAL	-	Phase Alternating Line
PC	-	Personal Computer
PID	-	Proportional–Integral–Derivative

PWM	-	Pulse Width Modulation
RGB	-	Red, Green and Blue

CHAPTER 1

INTRODUCTION

1.1 Introduction

As the earth getting older by the year, the number of natural disasters also increase accordingly. When a disaster strikes, victims are forced to be isolated from the city and safety regions. As such, victims are stranded on leftover building or bunkers. After the disaster, usually, a search and rescue (SAR) mission will be conducted to locate and rescue the victims. Even though quick action is taken but the availability of vehicle to save all the victim is not enough. Victims that are injured from the crash need emergency to patch themselves while waiting for rescue. The need to design transportation and deployment of emergency supply is needed to allow victim as such to be able to access of such supplies and allowing them to survive longer in disastrous situation. The need of developing of a transportation and deployment of a semi-autonomous aerial robot for search and rescue mission is needed.

1.2 Project Background

In the year 2011, in the province of Battambang, Cambodia, a massive flood struck the continent forcing thousands of flood victims to seek refuge on patches of the land. The flood that has influenced seventy-five percent of the nation's territory region, and only a strip of raised land accessible only by boat. Sen January, a representative in Cambodia for Save The Children said "What we have done is provided immediate relief. But collectively, we have not been able to reach every family." (Fuler, 2011). She

continues to explain how hard to send necessities to refugees that are desperately in need of supplies.

As technology progress along the year, aerial robot or unmanned robotic air vehicles UAVs are created. An aerial robot or unmanned aerial vehicle (UAV) are words that are frequently used when describing a robot that has propeller around its supporting frame that allows it to fly at ease. Having modern world creation of a micro electro mechanical system sensors and Inertial Measurement Unit (IMU), UAVs can guide itself to follow a specific path set by the user. There are many variants that are on the market, but this project will focus on the usage of a quadcopter or specifically the DJI F450 quadcopter attached with the APM 2.8 install with the software called Adopter. Adopter is a rotorcraft UAV with full self- sufficient ability that is fit for a full scope of flight necessity from quick-paced FPV dashing to a smooth ethereal photography, and completely self-sufficient complex mission which can be modified through various perfect programming ground station (Anon., 2016).Currently, most drone are used for chance appraisal, mapping and planning for the influenced location (Anon., 2015).

1.3 Problem Statement

Nowadays, unmanned aerial vehicle (UAV) has turned out to be progressively normal and expand a gigantic scope of size and shape. UAVs are used as a device photography for new casting and movie, fast object or material transportation and delivery, information obtaining, land mapping of unreachable terrain and location building checking, law enforcement and border control surveillance. (Joshi & Divya, 2017). When flying UAVs, an important point that cannot be overlooked is that for a UAVs to fly autonomously, a ground-based controller and a system of communication