APPLICATION OF DRONE FOR INSPECTION AND IMAGE PROCESSING

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SUPERVISOR'S DECLARATION

I have checked this report and the report can now be submitted to JK-PSM to be delivered back to supervisor and to the second examiner.

Signature : .....

Name of Supervisor : DR. REDUAN BIN MAT DAN

Date : .....

APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Plant and Maitenance).

Signature : …….

Name of Supervisor : DR. REDUAN BIN MAT DAN

Date : ……..

DEDICATION

To my beloved mother and father

ABSTRACT

The aging and reduction in quality or strength of some structures such as buildings is a bigger concern. Hence, regular inspections in order to preserve the structures are really necessary. Consequently, there is an increase in cost especially in terms of safety due to the difficulty to access. Drones would be the most suitable tool replace the existing method of visual inspection, which provide several advantages. This study aims to apply technology of drones for visual inspection without consuming a lot of cost. In order to achieve the aim of this study, several objectives have been identified and there are to study and explore the drone technology in maintenance for inspection, improve the current inspection method using drone by adding image processing techniques and study on the defects found during inspection and analyze them through image processing techniques. This study starts with carrying out inspection using a drone then if there any failures such as corrosion and cracks, a further investigation and analysis will be performed on MATLAB. The accuracy of the technique used to find the length of crack is found to be 73% and 27% error from the original length measured. The results obtained and recommendations are discussed and suggested at the end of this report.

ABSTRAK

Penuaan dan pengurangan kualiti atau kekuatan sesuatu struktur seperti bangunan adalah sesuatu yang membimbangkan. Maka pemeriksaan berkala bertujuan memelihara struktur sangat diperlukan. Oleh itu, terdapat kenaikan kos terutama dari segi keselamatan kerana kesukaran untuk mengakses. Dron boleh menjadi alat yang paling sesuai untuk menggantikan kaedah pemeriksaan visual yang sedia ada, yang mana memberikan beberapa kelebihan. Kajian ini bertujuan untuk mengaplikasikan teknologi dron untuk pemeriksaan visual tanpa menelan kos yang banyak. Bagi mencapai tujuan kajian ini, beberapa objektif telah dikenal pasti anatranya ialah untuk mengkaji dan meneroka teknologi dron dalam penyelenggaraan untuk pemeriksaan, menambahbaikan kaedah pemeriksaan sedia ada yang menggunakan dron dengan menambahkan teknik pemprosesan gambar dan untuk mengkaji kecacatan yang ditemui semasa pemeriksaan dan menganalisisnya melalui teknik pemprosesan gambar. Kajian ini dimulakan dengan melakukan pemeriksaan menggunakan dron dan sekiranya ada kecacatan seperti karat dan retakan, penyelidikan dan analisis selanjutnya akan dilakukan di dalam MATLAB. Ketepatan teknik yang digunakan untuk mencari panjang retak didapati 73% dan 27% kesalahan dari panjang asal yang diukur. Hasil yang diperoleh dan cadangan dibincangkan dan dicadangkan pada akhir laporan ini.

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LIST OF ABBREVIATIONS

HVAC	Heating Ventilation Air Conditioning
PV	Photovoltaic
MATLAB	MATrixLABoratory
UAV	Unmanned Aerial Vehicle
RC	Remote Control
ABS	Acrylonitrile butadiene styrene
USB	Universal Serial Bus
PP	Polypropylene
RGB	Red, Green, Blue
HSI	Hue, Saturation, Intensity
GUI	Graphical User Interface
pH	Power of Hydrogen
HD	High Definition

LIST OF SYMBOLS

θ	=	angle measured with reference to red axis of HSI

CHAPTER 1

INTRODUCTION

1.1 Background

Carrying out routine inspection on every structures or equipment is vital because it enables us to identify whether they need to be amended or it is eligible to start operating on a job site. Inspection is a kind of process to evaluate the status of equipment or machines and also identify the required tools or materials in order to get them fixed. Minor issues can be identified by performing maintenance inspection before a highly-cost repair is needed in order to repair them. It helps in making sure that all machinery items are functioning well and properly without facing any failures and it can also help to avoid equipment downtime.

When it comes to inspection, it does not necessarily focus on a common one like construction inspection. There are several types of inspection that can be classified. Firstly, safety inspection. This inspection especially involves with something that has to do with the safety such as first-aid kit which required to be checked and refilled if some of the tools inside it have been used up and harness equipment. The assessment of the condition of the bulb should also be performed regularly and this inspection goes under lighting inspection. HVAC inspections play an important role. In this kind of inspection, the most crucial components that should be inspected regularly are the intake of air, filers, motor and duct work. Those components should be cleaned regularly as well.

Apart from that, in plumbing inspection, the system should be inspected annually to ensure there is no leakage, noises and damage found. Water boiler and heaters must be always fire-tested. Replacing to a new one is crucial if there is any component found defects. Building internal inspections are focusing more on the condition inside of the buildings like the walls, ceilings and floors for damage, leakage and other defects. Ensure to discard hazards and make sure proper operation of doors and locks. Unlike building interior inspections, checking the condition of paints, walls, windows and doors are going under building exterior inspection. Roof which located on top of the building should be inspected as it is part of this type of inspections as well.

Physical inspection of the power plants is performed by allowing the workforce or also known as an inspector to inspect a plant site and check on the parameters that are possible to measure manually or using any measuring instruments. It is undeniable that this process of inspection is rather tough to be done. The difficulty and accuracy levels are based on how large the plant and site are. The data that will be collected and monitored by human workforces are something that related to the PV array/module/cell, weather parameter, dust accumulation on the PV system, and careful investigation of the mounting structures used for installation then it is reported in the form of either physical printed papers or any tablet devices. It is possible to carry out physical inspection if the plant size is smaller and moderate accuracies can be obtained. In the case of larger areas of plant size, the probability of getting more human errors is high and it probably takes the lengthy process.

The application of drones can replace visual inspection of workers which benefits them in many aspects. Some of the advantages are speed, provide safety to the workers, cost reduction, share-ability with more stakeholders instantly and

manoeuvrability by making use of automated flights. Drones are an emerging technology with many potential applications in plant maintenance (Kumar et al., 2018). The reduction in number of injuries in plant sites for instance, in some of the high-elevation places can be increased by applying the use of drone for inspection. Its application for inspection is not only limited for the outdoor environment, but it can also be useful for indoor like the inside of a boiler and a vessel. Since, this powerful technology invention is completed with an imaging device and multiple sensors, hence it is possible for it to be used in a harsh environment and perform an inspection (Khosiawan & Nielsen, 2016).

1.2 Problem Statement

If drones are used to replace the existing method for inspection, the process of inspection would be much faster and cheaper. However, the cost of building or development of drones may be high. In order to reduce the inspection cost, it is very vital to understand the functionalities and capabilities of drone used. So this study is to propose a new techniques involved after inspection which is image processing for analysis process.

1.3 Objective

The project's objectives are as followed:

1. To study and explore the efficiency of drone technology in maintenance for inspection.
2. To improve the current inspection method using drone by adding image processing techniques.
3. To study on the defects found during inspection and analyze them through image processing techniques.

1.4 Scope of Project

The project's scopes are:

1. This project is focusing on the use of a drone for inspection any areas.
2. Data collected related to aim and objectives.
3. Develop data in the form of picture or video documentation and report using MATLAB software.

4. The method of using MATLAB software for the study of crack and corrosion detection.

CHAPTER 2

LITERATURE REVIEW

2.1 Defects of Building in Malaysia

Improper Management and inspection are one of the main causes of defect issues in buildings. Defects define as a defect in design or material to build it that can cause failures on its structure and non-structure that eventually causes damage to the property (Hanafi et al., 2018). It can be caused by various mechanisms and multiple factors might influence it. Generally, the defective agent that results in disability can be categorised into four parts named as mechanical agents, biological agents, natural disaster and chemical agents. Table 2.1 below shows a summary for each defect agent.

Table 2.1: Summary for Each agent

	Agents	Description
Mechanical	Wind Vibration Water	Mostly occurs by external factors like wind, water, vibration that constantly create stress on the buildings. Types of damages arising from this agent are like fracture, paint peeling, wall cracks and sediment.

Biology	Animal Human Plant Micro-organisms	Categorised into four parts which are animal, humans, plants and micro-organisms. This will result in damage to building walls to fracture, peeling parts, fissures on the barriers caused by foreign plants and blockage of drainage channel due to crevices.
Natural Disasters	Earthquake Tsunami Flash flooding Landslide	Earthquake, tsunami, flash flooding and landslide are types of natural disasters commonly occur in Malaysia. From these disasters, they can create another disaster which is damaging places and human life caused by destructive force.
Chemical Reaction	Radiation Climate change Heat	Chemical reaction occurs when two or more chemicals interact each other or change then produced mixed chemical properties. In this reaction, normally heat, pressure, radiation or the presence of catalyst are needed. Property reference refers to the situation where decay and erosion affected continuously.