

UNIVERSITI TEKNOLOGI MARA

**REAL-TIME INTELLIGENT RECYCLE WASTE
DETECTION AND CLASSIFICATION USING
YOU ONLY LOOK ONCE VERSION 5**

AIMAN SYAFWAN BIN AMRAN

BACHELOR OF COMPUTER SCIENCE (Hons.)

AUGUST 2023

ACKNOWLEDGEMENT

Alhamdulillah, praises and thanks to Allah because of His Almighty and His utmost blessings, who bestow me the knowledge, strength, and perseverance that I was able to finish this research within the time duration give.

My special thanks go to my supervisor, Madam Rosniza Binti Roslan. I am indebted to her who have given me numerous suggestions on how to improve my project and I am extremely fortunate to have her as my supervisor.

Moreover, special thanks towards both of my parents for their continuous support and encouragement to me during the process of completing this project. Besides, to all my friends, thank you for sharing your knowledge, and giving the guidance and support I greatly need when I face any difficulties to finish this project.

ABSTRACT

Recycle waste is an integral part of our daily lives. It generates various type of waste materials in our homes, workplaces and communities. With a growing population and urbanization, it is crucial to prioritize responsible waste management practices to address the environmental challenges faced by the country. In Malaysia, the traditional approach to recycle waste detection and classification primarily relies on manual sorting and visual inspection by waste management personnel. When recyclable waste arrives at recycling centers or facilities, workers manually separate the materials based on their visual appearance and physical characteristics. Because of that, this project aims to detect and classify a typed of recycled waste such paper, plastic and metal. It uses YOLOv5 object detection and classification algorithm. This project uses the images of paper, plastic and metal gathered from Kaggle and GitHub dataset. This system was put to two tests of testing which were functionality testing of the whole system and the metric evaluation of the object detection and classification model. The object detection and classification algorithm achieved 91.9% mean average precision in metric evaluation. The system was developed as a web-based system in order to make it easily accessible by the target user which the governance body from any public nor private sectors. The recommendation on the future work is to improve the detection model for it to be able to detect small size object from the image to make the system more reliable.

TABLE OF CONTENTS

CONTENT	PAGE
SUPERVISOR APPROVAL	ii
STUDENT DECLARATION	iii
ACKNOWLEDGEMENT	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	x
LIST OF TABLES	xiv
LIST OF ABBREVIATIONS	xvi
 CHAPTER ONE: INTRODUCTION	
1.1 Background of Study	1
1.2 Problem Statement	2
1.3 Project Objective	4
1.4 Project Scope	4
1.5 Significance of the Project	4
1.6 Project Organization	5
 CHAPTER TWO: LITERATURE REVIEW	
2.1 Introduction	7
2.2 Waste Management	8
2.2.1 Plastic	9
2.2.2 Paper	11
2.2.3 Metal	13
2.3 Internet of Things	14
2.3.1 Coding Layer	15

2.3.2	Perception Layer	15
2.3.3	Network Layer	18
2.3.4	Middleware Layer	18
2.3.5	Application Layer	18
2.3.6	Business Layer	18
2.4	Image Processing	19
2.5	Image Acquisition	20
2.6	Image Segmentation	20
2.7	Feature Extraction	22
2.8	Detection and Classification	23
2.8.1	You Only Look Once Version 5	24
2.8.2	Faster Region- Convolutional Neural Network	26
2.8.3	Single Shot Detector	28
2.8.4	Summarization of Previous Image Detection	30
2.9	Conclusion	31

CHAPTER THREE: METHODOLOGY

3.1	Introduction	32
3.2	Project Framework	32
3.3	Hardware and Software Requirements	33
3.4	Timeline	34
3.5	Conclusion	35