CHAPTER I
INTRODUCTION

1.1 Background

Intelligent Transportation System (ITS) becomes more essential for a country because it is an effective way to solve the traffic conditions in urban roads [3] as such with many traffic crimes or traffic violations in Indonesia. ITS is a high intelligence system that relies on advanced technology in the fields of electronics, computers, and telecommunications combined with principles of strategic management to improve overall transportation functions [4]. Such systems help to get real-time information regarding traffic conditions on the road so that this information can be used efficiently to control transportation traffic [5]. Computer vision is a field of science from AI (Artificial Intelligence) [6]. Algorithms from the field of computer vision can teach machines how the human visual system works [7], therefore the ability to detect objects is needed. Object detection is a technique used in digital image processing that is used to detect human faces, buildings, trees, cars, or other objects. The main purpose of object detection is to determine whether there is an object in an image. This system can be used to develop ITS systems on existing traffic in Indonesia so that traffic violators can be known more quickly by looking at the vehicle body type shown on the surveillance camera. Traffic conditions on the road have been monitored using surveillance cameras today. This surveillance camera will later produce a recording of traffic conditions that allows the presence of traffic crime or traffic violation.

Object detection is a process of detecting a moving or moving object in a video that has been converted into an image sequence [8], which is a sequence of pieces of an image from a video that is more difficult than any image classification, especially in real-time, mainly because it involves a combination of object classification and object localization in an image. Convolutional Neural Network (CNN) is a set of Deep Learning algorithms that has more advantages and efficiency than any neural network algorithms [8]. It can take an input of an image then import various objects from the image and differentiate one from the other. YOLO is one of the fastest object detection methods which supports object detection in real-time and could be useful for the intelligent surveillance system. The YOLOv3 is the latest version of its predecessor that has the capability of detection at real-time performance, which

is very compatible with the system to detect an object at the traffic site [9].

Vehicle detection is an important link for the data acquisition of ITS system [10]. Therefore, we need a program that can detect the type of vehicle that passes through the road classified by its body type to help the surveillance camera detect the presence of traffic violations. This recording can be utilized information using image processing. One of the uses of information that can be used is to detect the vehicle body type to improve the ITS. Deep Learning is used which too supports object detection in real-time. This system would be a part of an intelligent surveillance camera where the system will try to collect some statistics about various vehicles passing a certain region at a certain time. Vehicle detection is an important link for the data acquisition of ITS system [10]. Therefore, we need a program that can detect the type of vehicle that passes through the road classified by its body type to help the surveillance camera detect the presence of traffic violations. This recording can be utilized information using image processing. One of the uses of information that can be used is to detect the vehicle body type to improve the ITS.

This thesis is inspired by some of the research that has been done on a similar topic in this thesis. The first research was "Detection of Vehicle Types Using OpenCV" conducted by Alvin Lazaro, etc. This study uses the Haar-like feature to detect vehicle objects with the average accuracy rate for three different road conditions (quiet, normal, and congested) is 77.8%, 47.5%, and 28.2% [11]. The next research was object detection using Performance Enhancement of YOLOv3 by Adding Prediction Layers with Spatial Pyramid Pooling for Vehicle Detection. This research uses Darknet-53 as its implementation to a vehicle detection using a surveillance system [12]. The next research was automatic parking marking Using YOLO to detect the availability of vehicle parking spaces on CCTV video by Evan Tanuwijaya. This research uses the YOLOv3 method with a rate of accuracy of 94.46% in cloudy weather [13]. The next research was Vehicle Detection Based on Improved Yolov3 Algorithm which has a higher detection accuracy and a higher detection rate than the traditional algorithm [14].

This thesis proposes to use the YOLO method as a method for detecting vehicle body types. YOLO implements a single neural network throughout the image during training and testing time which makes it have a higher speed [15] for object detection than other methods so it is very suitable to be applied to real-time object detection systems. The performance parameters used include accuracy, precision, Intersection over Union (IoU), and Mean Average Precision (mAP). The designed system will detect the presence of a vehicle and the vehicle is classified by seven classes of body types of vehicles that have been trained.

1.2 Problem Identification

Based on the background of related problems, several problems can be formulated such as

1. Implementation of the object detection system using the YOLO method.
2. Performance parameter of accuracy, IoU, Precision, and mAP for object detection.

1.3 Objective and Contribution

Based on the problem formulation that has been explained, the objectives and contribution of this final project are:

1. Design and implement an object detection system for vehicle body types using the YOLO object detection method.
2. Measure the performance of the YOLO object detection method.
3. Analyze the performance of face recognition technology based on the parameters of accuracy, precision, IoU, and mAP.

1.4 Scope of The Problem

This Final Project has the following scopes of problem.

1. The object detection system uses the YOLOv3 architecture.
2. The dataset used in this method is limited to only detecting vehicles available on the website https://ai.stanford.edu/~jkrause/cars/car_dataset.html.
3. The device for taking pictures used is a webcam with a resolution of 720p and a DSLR camera with a resolution of 1080p.
4. Parameters analyzed were precision, accuracy, IoU, precision, and mAP values.
5. The output of this system is bounding box vector and class prediction from the object detection.

1.5 Research Methods

This Final Project is divided into 5 work packages.

1. WP1: Literature Study
   This stage Conduct literature studies by searching, collecting, and understanding journals, papers, articles, books, websites and other references related to data science, web crawling, deep learning, object detection, and YOLO.

2. WP2: Dataset Retrieval
   This stage is done by taking the dataset from the website https://ai.stanford.edu/~jkrause/cars/car_dataset.html. Then the labeling of each image is carried out based on seven types of vehicle bodies.

3. WP3: System planning
   The system is designed based on the flowchart that has been made. To realize the system, Python programming language, Visual Studio Code application, OpenCV library, and Requests library are used.

4. WP4: Test Results Analysis
   The system configuration is tested analyzing the performance by the parameters of accuracy, IoU, precision, and mAP.

5. WP5: Conclusion
   This stage concludes the results of the testing and data analysis process and compiles a report from the reports that have been made.

1.6 Writing System

Henceforth for the systematic writing of this Final Project is as follows:

- Chapter 2 BASIC CONCEPTS BASIC CONCEPTS
  This chapter discusses the basic concepts and literature review on YOLO object detection algorithms, Convolutional Neural Network (CNN), and Python.

- Chapter 3 PROPOSED MODEL SYSTEM DESIGN AND PROPOSED MODEL
  This chapter describes the system model design, performance parameter analysis and device specifications.

- Chapter 4 RESULT AND ANALYSIS
  This chapter highlights the result of YOLO algorithm, including accuracy, IoU, precision, and mAP.

- Chapter 5 CONCLUSION AND SUGGESTION
  This chapter consists of the final conclusion about this thesis and several suggestions that can further develop this project in the future.