PORTABLE AUTOMATED NUMBER PLATE RECOGNITION (ANPR) SYSTEM WITH DATABASE LABELLING INTERFACE

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This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for Bachelor of Computer Engineering Technology (Computer Systems) 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 partial fulfillment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours. The supervisory members are as follow,

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ABSTRAK

Kebelakangan tahun ini, sistem pengenalpastian nombor plat kereta automatik memainkan peranan penting dalam isu sekuriti. Sistem pengenalpastian nombor plat kereta automatik adalah satu sistem yang boleh mengenalpasti number plat kereta secara automatik daripada imej yang ditangkap dari kamera. Disebabkan kebilangan kereta sekarang meningkat banyak, system pengenalpastian nombor plat kereta automatik disyorkan untuk membanteras jenayah, perlindungan sekuriti, ataupun sistem parking. Namun begitu, harga sistem pengenalpastian nombor plat kereta automatik di pasaran sekarang agak mahal. Bukan begitu sahaja, process pemasangan dan yuran penyelenggaraan juga tidak murah. Oleh itu, project ini bertujuan untuk merangkan satu sistem pengenalpastian nombor plat kereta automatik yang mudah alih dan bajet supaya sistem ini boleh dimiliki oleh orang ramai. Projek ini menggunakan Raspberry Pi 4 Model B untuk menggantikan computer traditional yang mahal dan besar. Componen penderia pengerakkan diguna untuk mengesan kereta. Camera juga digunakan untuk menangkap gamber kereta apabila kereta dkesan oleh penderia pengerakkan. Selepas itu, imej yang ditangkap itu akan dijalani beberapa imej proses untuk ekstrak nombor plat dari imej yang ditangkap. Selepas nombor plat kereta diekstrak, maklumat-maklumat akan disimpan dalam pangkalan dalam dan boleh rujuk balik menggunakan antara muka “database labelling”.

ABSTRACT

Over the years, an automated number plate recognition system (ANPR) has played a significant role in security issues that arise globally. An automated number plate recognition (ANPR) system is a system that able to recognition number plates from image capture in a computer. As the number of vehicles on road is getting more nowadays, the ANPR system was introduced to help identify vehicles that may help in criminal deterrent, security problems, or parking systems. With the current market, the price of the ANPR system is overpriced. Moreover, the installation of the current ANPR system is complex. The maintenance fee of the ANPR system is also costly. The purpose of this project is to design a low-cost Portable Automated Number Plate (ANPR) system with database labelling interface. In this project, the Raspberry Pi board is used to replaced conventional large-size personal computers as central processing units in the ANPR system. A motion sensor acts as a vehicle detector. Raspberry Pi NoIR Camera can capture a moving vehicle when the motion sensor detects an object moving at a certain distance. Once the image is captured, number plate extraction, number plate segmentation, and number plate recognition will be done by Raspberry Pi. This paper will study and analyse the functionality and efficiency of the method used in the ANPR system The extracted plate number will then be saved into the database and displayed in the user-friendly database labelling interface.

DEDICATION

This thesis is dedicated to my parents and family member who gave me moral support and encouragement during the duration of completing this report. I would also like to dedicate this to my friends and supervisor that always possibly help me when I have trouble with this project.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

ALPR	Automated License Plate Recognition
ANN	Artificial Neural Network
ANPR	Automated Number Plate Recognition
CCTV	Closed-circuit Television
CNN	Convolutional Neural Network
CPU	Central Processing Unit
CSI	Camera Serial Interface
FGPA	Field-programmable Gate Array
GPIO	General Purpose Input/Output
GPS	Global Positioning System
KNN	K-nearest Neighbour
MLP	Multilayer Perceptron
NoIR	No Infrared
OCR	Optical Character Recognition
OpenCV	Open Source Computer Vision Library
PIR	Passive Infrared
SVM	Support Vector Machine

CHAPTER 1

INTRODUCTION

1.1 Introduction

Wisconsin (1941) stated that a legally registered vehicle will have a registration plate, also called a license plate or number plate. A registration plate is a plastic plate with a unique ID attached at the front and rear part of a vehicle. This may differ from countries and types of vehicles according to the law set by the countries. According to Boerwald et al. (2005), the unique ID on the registration plate is made up of a combination of alphanumeric and numeric ID which is used as a vehicle identifier. Information such as ownership of the vehicle, type of vehicle, the colour of the vehicle is recorded under the registration plate. In short, the registration plate act as a unique identifying tag of the vehicle which can be traced when needed. Over the years, the registration plate has a significant role in security issues that arise globally. CCTV is installed on the roadside or at the entrances of the location to trace the vehicle. Andrzej Dziech et al. (2013) stated that the problem arises when someone has to review back the CCTV frame to frame to identify certain registration plates. Soon, the registration plate recognition system called Automated Number Plate Recognition (ANPR) was developed to reduce the burden. According to Du et al. (2013), Automated Number Plate Recognition (ANPR) is a system using a computer with a camera that is used to capture the registration plate of the vehicle then being processed to extract the unique ID on the registration plate. Once the information is being extracted successfully, it will be saved in the computer with several pieces of information such as date and time, location, etc. Ozbay & Ercelebi, (2005) stated

that the existing Automated Number Plate Recognition (ANPR) System is facing several issues such as high cost, complex installation, and high maintenance fees. The purpose of my project is to develop a low-cost Automated Number Plate Recognition (ANPR) System with database labelling.

1.2 Problem statement

Automated Number Plate Recognition (ANPR) System is now widely required in various fields such as traffic departments, security companies, parking system, auto-pay system, etc. There are still a lot of fields using a video camera or closed-circuit television (CCTV) to record the incoming vehicles. Manually checking images or videos and matching the license plates with registered vehicles are time-consuming. The existing Automated Number Plate Recognition (ANPR) System is high in cost as it required a high-resolution camera and a good performance computer. Moreover, the installation of an Automated Number Plate Recognition (ANPR) System is complex and maintenance cost is high.

1.3 Objectives

The main objectives of this project are:

1. To develop and study the method used in a Portable Automated Number Plate Recognition (ANPR) System with database labelling interface.
2. To analyse the functionality and reliability of the system in detecting the number plate and recognising characters.

1.4 Project scope

- Use Raspberry Pi 4 Model B as a computer
- Use a camera and sensor to capture the image of a vehicle
- Designed to recognize unique ID on the number plate
- The result will be saved in a database with a database labelling interface
- The database is a local server database
- Exterior design is not covered

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

According to Du et al. (2013), the Portable Automated Number Plate Recognition (ANPR) System is mainly a real-time system used to automatically detect and recognize number plates from the captured image by using image processing techniques. This system is now widely used globally as the number of vehicles increase day by day. According to Peter Joyce (2010), his system was firstly invented by the Police Scientific Development Branch in Britain in 1976. The main purpose of this system during those days was to help in a criminal deterrent. However, nowadays ANPR is widely used for several purposes such as electronic payment systems, smart parking systems, garden-surveillance systems, etc.

A Portable Automated Number Plate Recognition (ANPR) System is mainly divided into five main stages which are image acquisition, number plate detection/extraction, number plate segmentation, number plate recognition, and database labelling. Image acquisition is a procedure to obtain an image with a possible existence of a number plate. Number plate detection/extraction is mainly a stage to detect a number plate region on a captured image. Number plate segmentation is a procedure to segment each character on the number plate into several sub-image. Number plate recognition is a procedure to recognize the character in the sub-images segmented on the previous procedure. Database labelling is a procedure to collect data extracted by the system and label them with little extra information such as date and time and GPS coordinates.