License Plate Recognition Using Raspberry Pi & Tesseract OCR Engine

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***Abstract*— In this document we shall be discussing our project concept. Firstly, we will go through a brief idea of what our project is. Then the goals of the project and what we want our project to achieve. Next, we'll go through the specifications and give a list of what hardware we need and what software we currently plan on using. Finally, we will do a literature review, and discuss recent studies done on the relevant areas of our project.**

Keywords—Police, technology, computer vision, raspberry pi, tesseract.

I. INTRODUCTION

Ever since the recent mobile technology revolution, technology has become more and more a part of everyday life. This has brought with it many good things and many bad things. For instance, many police cars have laptops built in used to access information on potential criminals. With this has made it easier for the police to catch criminals but having laptops and phones in a car has proven to be a massive distraction for drivers. Our project will eliminate this distraction, automating the process of searching a license plate to see if the police need to stop them, completely removing the need for police offices to manually, find and record a license plate. Allowing them to spend their time more productively and focus on the road, making their job less dangerous.

II. SYSTEM DESIGN & APPLICATION

A. Optimizating a Method Already in Use

In a typical police officers daily shift, they do many things. Respond to calls, enforce traffic laws, surveillance for people breaking other laws, etc. Among these tasks, most of their time, position dependent, is spent driving around in their police car. While driving it is common for them to manually search the license plate number of cars they see through a police database, retrieving information on the owner. This information depending on the state can include the registration, national crime information center data, wanted status, driver information, bail conditions, felon indicators and prior in-house incidents with the owner. Traffic stops conducted with this method are often referred to as "bingo" stops. This is already a tried and tested process but has room for optimization.

The proposed method of optimization is through the use of a camera placed on the front of a police car with software capability of reading multiple license plates and then checking the reports tied to the vehicle owner. Once the report is pulled by the software, the report is analyzed automatically and if any flags appear such as a warrant or suspended license for example, the officer is given a notification through a sound prompt. Once the officer is notified, they will then manually check the license plate to assure no mistake was made by the software and if a match occurs, they can then intervene however deemed appropriate.

Using this system, the officer will no long have to spend the time manually typing plate numbers into the computer and will have the ability to give full attention to driving or making sure other drivers are adhering to the laws. In combination with relieving the officer of distraction, this system would also optimize the capabilities of using the police database to check license plates. Rather than having to manually check each license plate one at a time, the software would be able to optimize this task, increasing the number of plates read in a given amount of time, as well as being able to read plates at times the officer wouldn't be able to [4].

B. Data Analytics

This system would also extend past the use as a device to pull drivers over. This system could also be used to collect and analyze data. For example, the police database already supplies information from the National Crime Information Center. This includes information from 21 files including: stolen items, people enquiries (sex offender, gang affiliation, missing person) as well as pictures of the offenders to help law

enforcement identify them [1]. Using this information, locations of interactions with or even spotting's of said person can be logged into a database and further referenced creating crime statistics helping police further do their jobs.

C. Hardware Implementation

For our toy implementation of this system, our tentative plan is to use a Pi camera module connected to a Raspberry Pi. The Raspberry Pi was chosen as its hardware capabilities were capable for data and image processing, with a web search worth of previous computer vision-based projects already implemented. To simplify the process of connectivity with the Raspberry Pi, the Pi Camera Module V2 was also chosen to be used as the camera source. For the real system itself, other SoC (System on a Chip) and camera devices may be used, as the former hardware were chosen for its ease of accessibility.

D. Software Implementation

The software implementation for this project is using a computer vision system that can interpret the text of a license plate to search through a database. The image processing will be divided into two parts; plate detection, and character recognition. This is because it can be slow to recognize a character from the image, so to combat this, the processes are divided. Localizing and segmenting the license plate are key steps of the license plate recognition system. Because the license plate image is a sub-region that is very characteristic in the original image, and that is concentrated in a special part. Its gray value differs to that of periphery areas, thus there will be an obvious boundary, which will facilitate segmentation of image by edge detection.

The proposed method of computer vision is using the open source OCR engine, Tesseract, which was first developed by HP but more recently developed and used by Google [13]. This method begins the process by localizing the text, creating a region that is snipped from the overall image to be further analyzed. Next the orientation and number of the text is found using a method called "line fitting". Line fitting in this context will be simple because a license plate number is always horizontally oriented as well as only one line. Next, the spacing between characters is found. This is done by finding the number of pixels between the letters. Known information about license plates, the spacing between numbers/letters as well as colors will aid in this process [2]. Finally, the characters are identified. This is done by having the software classify the text or numbers based on their distinct shape [3]. This is possible due to license plates uniform text color as well as distinct edges.

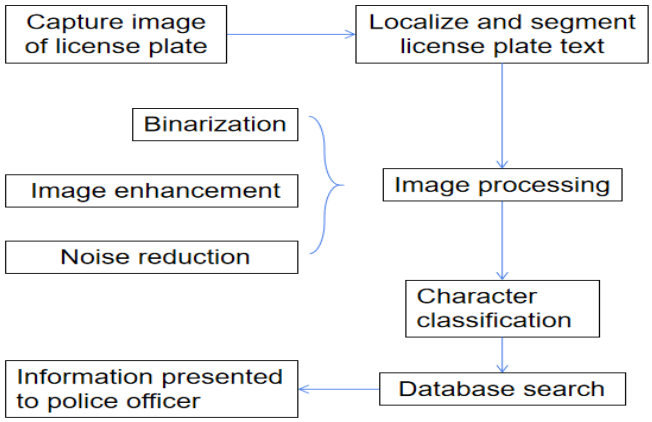

Fig. 1. Flow chart of system process.

III. Previous Work

Previous work relating to this project starts with a text recognition to speech program that uses tesseract, the proposed method in this project to recognize characters. The process that was used begin with image capturing and preprocessing. A still image was taken and changes such as: noise reduction, image enhancement and binarization to help with later image processing to give more accurate results [13]. Next, the text in the image was segmented for further analysis. This was done to separate the text to be recognized from the rest of the image which becomes irrelevant. The next step, and the most important was to recognize the text using the open source engine tesseract. Tesseract was chosen due to its better performance when matched against other open source engines [13].

In another project, Tesseract was used to automatically detect vehicles based on their license plate and visual features. The first portion of this project is relevant as it uses the same character recognition engine to complete the same task. Once again, Tesseract was chosen due to its open source availability in combination to its high accuracy [14]. To achieve the final goal of receiving a plate number from an image input, the same steps as previously discussed were taken. First the license plate in the image was localized and preprocessed for character recognition. This included the same steps of binarization and image enhancement as well as segmentation. Next, using Tesseract, the characters are recognized using both adaptive classification and repeating recognition [14]. Using this information combined with vehicle characteristic recognition, their project would verify if the vehicles identity. This is where our projects differ. Instead, in our project, the outputted license plate number is then searched through a cloud database where various information is supplied to the police officer.

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