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Engraved Character Recognition Using Computer Vision To Recognize Engine And Chassis Numbers

Computer Vision Technique To Identify Engraved Numbers

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***Abstract*—Optical character recognition systems (OCR) have been effectively developed for the recognition of printed characters. One such application is the identifying engine number and chassis number which is engraved on machine parts. Manual logging of serial numbers in industries is very tedious and a time consuming affair. Our proposed system is robust under poor illumination conditions. Our overall system is efficient and can be applied in real-time applications. Since OCR is well-studied area where powerful algorithms like Zidouri algorithm for letter segmentation, Blob detection algorithm for removal of unwanted areas and character extraction, Hilditch algorithm for Arabic character recognition already exists, our OCR based engraved character recognition yields more accurate results up to 99.99% accuracy. The paper explains how optical character recognition technique along with computer vision can be applied to identify engine number and chassis number which are engraved on two and four wheeler vehicles.**

Keywords— OCR, Preprocessing, Segmentation, Engraved character recognition, Vehicle registration module.

I. INTRODUCTION

Optical character recognition is an awesome computer vision technique with various applications ranging from saving real text scripts digitally and deriving context based intelligence using natural language processing from the texts. One such application is to identify engine number and chassis number which is engraved on machine parts. The low cost computer vision based system can detect machine part features and serial numbers and creates a one to one map between them for identification and quality control [12]. The serial numbers were engraved on the metal parts. This can be solved in two stages. A preprocessing stage which extracts the region of text and segments out the characters and in later stage OCR system identifies the characters based on a retrained model built using machine learning techniques. OCR systems and research have continued to improve over the years, and have now reached a point to identify machine printed character images. Optical character recognition is simultaneously machine-readable and human-readable text. Reading serial numbers in automotive or electronics applications becomes easy because of the optical character recognition. Thus optical character recognition is a fast developing domain in computer vision [13]. As of now computer vision based character recognition is far behind the capability of human beings in recognizing characters. Engraved numbers are used in a variety of cases, especially in case of vehicles. In case of engraved numbers in many cases there is no difference between character color and background color, especially if a painting is carried out after engraving. A character is often a collection of distinguished dots than a continuum. There is a mix up of reflected light and scattered light. Color is not consistent across character area or background area. These aspects of engraved numbers make conventional OCR approaches not suitable for engraved numbers [11]. The paper illustrates the technique of optical character recognition for engraved numbers on metal surfaces. The paper also explores technology domains such as lighting, segmentation of characters and multiple approaches to character classification.

II. ENGRAVED CHARACTER RECOGNITION SYSTEM

1) Engraved Character Recognition

Machine vision and image processing algorithms have attempted for several years to be used in industrial applications. Character extraction and recognition in the context of engraved character present several applications such as quality control or traceability. Engraved characters are usually a limitation for character recognition as their extraction is difficult due to the small contrast with the background [4]. A vehicle identification number, commonly abbreviated to VIN, or chassis number, is a unique code including a serial number, used by the automotive industry to identify individual motor vehicles, towed vehicles, motorcycles, scooters, and mopeds as defined in ISO 3833. VINs were first used in 1954 [6]. From 1954 to 1981, there was no accepted standard for these numbers, so different manufacturers used different formats. In 1981, the National Highway Traffic Safety Administration of the United States standardized the format [6]. It required all over-the-road vehicles sold to contain a 17-character VIN, which does not include the letters I (i), O (o), or Q (q) to avoid confusion with numerals 1 and 0. The VIN or chassis number is composed of three basic sections viz. World manufacturer identifier or WMI code, vehicle descriptor section or VDS and vehicle identifier section or VIS [6]. Whereas engine number may refer to

identification number marked on an engine of a vehicle. The engine number is separate from the chassis number. Every vehicle engine is marked with an engine number by the factory. The engine number includes coded information [1] which can be decoded to reveal information such as year of manufacture, country of manufacture and engine type. Light polarization and scattering of light creates difficulty to recognize the engraved number. Even when fonts are thin, it becomes difficult to recognize exact characters. In engraved character recognition there are different stages such as preprocessing, segmentation, thinning, feature extraction and classification to overcome these difficulties.

Fig.1. Engraved number on a Honda City car

Fig.2. Engraved number on a machine part

2) Research Objectives

Real time number identification on machine parts especially on two and four wheelers. To explore technology domains such as lighting, effect of lighting conditions on vehicle images while capturing the image, segmentation of characters and exploring new spaces for character representation. To develop a library of optical character recognition for engraved numbers on metal surfaces. To explain new technology using computer vision along with optical character recognition and JAVA Programming to identify chassis numbers and engine numbers which are embossed on machine parts.

III. SYSTEM BLOCK DIAGRAM

To identify Engine number and Chassis number JAVA Programming has been done which provides various in-built tools for accurate identification of engraved numbers. We are using JAVA Programming language because of its number of salient features. The key considerations of JAVA language includes it is simple, secure, portable, object-oriented, robust, multithreaded, architecture-neutral, high performance, distributed, dynamic as well as compatible to work with windows, graphics and text.

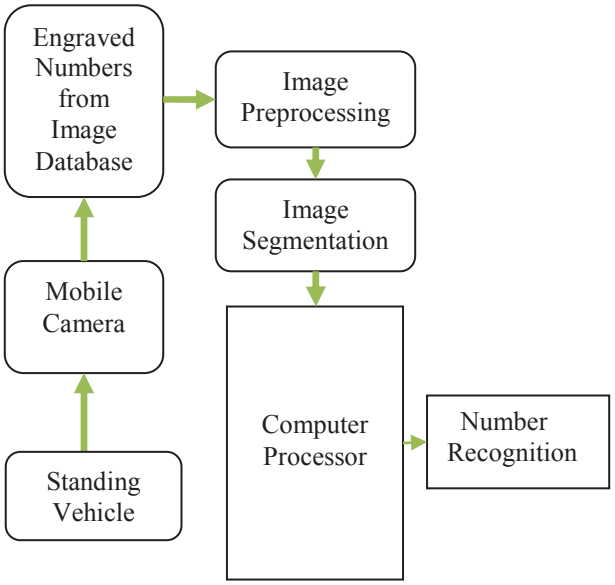

Fig.3. Engraved Character Recognition System

Fig.3. shows a block diagram of engraved character recognition system. As shown in figure different engraved numbers from different two wheelers and four wheelers are stored together in image database. As every two wheeler or four wheeler is having unique engine and chassis number, the images are stored in the database in such a way that every vehicle contains its own engine and chassis number. All the images are captured using simple mobile camera. There is no any need to go for high resolution camera as the images captured from mobile camera gives us accurate identification of each and every engine as well as chassis number. Optical character recognition technique is applied to all mobile camera captured images prior to segmentation process. Processing stage input is the image of vehicle. Since images are taken in outdoor environment the image quality may be affected by the luminance, reflections and shadows. The preprocessing step [10] is an important step that consists of binarization, smoothing, skew detection, thinning and baseline detection to improve performance of OCR system. In our work all these preprocessing steps are done by implementing JAVA programming to all the images which are stored in image database. It directly affects the reliability and efficiency in the rest of the steps. This step prepares the input image for the subsequent segmentation and feature extraction steps. What we do in this step solely depends on what kind of input image we expect and what we need to do with feature extraction at a higher precision. All image processing steps including image preprocessing, image

segmentation and feature extraction are carried out in computer processor using JAVA programming and Eclipse as a tool. As any chassis number or engine number consists of string of alphanumeric characters along with numbers ranging from 0 to 9, character segmentation one of the most important step is done [9]. Since wrongly segmented characters may cause a lot of classification errors, character segmentation is observed in detail. All segmentation process is done using JAVA Programming. This system is also applicable to find out embossed numbers on three wheelers as well as heavy vehicles such as trucks, mopeds and containers too. But in our case we have focused mainly on two and four wheelers.

IV. VEHICLE REGISTRATION MODULE

We have created one module using Eclipse as a tool for complete information of a vehicle. This module gives detail information regarding registration of a vehicle, vehicle information and its engine number and chassis number. Vehicle registration includes registration for two wheelers as well as four wheelers. We can add user, edit user or can remove user whenever needed. We can upload images which are stored in image database for accurate identification of chassis number as well as engine number [5]. The pixel values in X and Y directions are obtained using this registration module. The module looks like as shown in table I below.

Table I. Vehicle Registration Module

User Management	Vehicle Registration
Add user	Registration- two wheelers or four wheelers
Edit user	Vehicle info- vehicle type, vehicle weight etc.
Remove user	Upload image and search by chassis number
Help-Help	Upload image and search by engine number

V. RESULTS

We have tested twenty images of different two wheeler and four wheeler vehicles. All these images are stored in image database. We have covered almost every company vehicle to test our results. Petrol and diesel model vehicles both considered while taking the image. We have got results of all these images with almost 99.99% accuracy. We are obtaining this much accuracy because we have stored all these images in a fixed format in image database and vehicle registration module after JAVA programming gives us correct results which matches with our original image database. Because of this reason when we obtain results with our technique and compare with image database, we get highest accuracy of character identification. We are getting results based on sheet format using vehicle registration module. The result which we obtain includes owner information as well as vehicle information. Owner information includes his/her name, age, address, Email-ID and phone number whereas vehicle information includes vehicle weight, engine number, chassis number, fuel type, vehicle color and its year of manufacture as shown in table below. Here are some of the results which we are getting using our vehicle registration module are listed below. We are getting results only for those vehicles whose engraved numbers viz. chassis and engine numbers are stored in image database as shown in the system block diagram.

TABLE II. RESULT FOR TWO WHEELER

Owner information	Vehicle information
Name- ANIKET PATIL	Weight-125 CC
Age- 26	Engine Number- JC36E7369957
Address- Cooper colony, Satara.	Chassis Number- ME4JC36KLC7127069
Email- aniketpatil946@gmail.com	Fuel Type- Petrol, Color- Black.
Phone Number- +91 9975498429	Year of Manufacture- 2012

TABLE III. RESULT FOR FOUR WHEELER VEHICLE

Owner information	Vehicle information
Name- ANURAG SINGH	Weight-600 CC
Age- 30	Engine Number- MAKGM858AF4003188
Address- KURLA Mumbai.	Chassis Number- MD626BG47F1A14018
Email ID-anurag10@yahoo.com	Fuel Type- Petrol, Color- Red.
Phone Number- +91 9890786546	Year of Manufacture- 2004

TABLE IV. RESULT FOR BAJAJ TWO WHEELER VEHICLE

Owner information	Vehicle information
Name-DHANANJAY JOSHI	Weight- 150CC
Age- 23	Engine Number- OE4GE2632783
Address- Wadgaon Sheri, Pune.	Chassis Number- MD634KE4XE2G39048
Email- dhananjay66@gmail.com	Fuel type- Petrol, color- Red.
Phone Number- +91 8793756913	Year of Manufacture- 2013

All these results are obtained using the registration module shown above and using Eclipse tool for JAVA Programming.

VI. CONCLUSION

Paper gives an idea about engraved character recognition. Engraved machine parts recognition to identify engine number and chassis number is achieved. OCR encodes information in a format that is both machine-readable and human-readable. Chassis number or engine number set in any font created for any language and for different character string can be achieved with almost 99.99% accuracy. For the task as sensitive as tracking stolen vehicles and monitoring vehicles this system gives best results. As this work gives best results to identify engine and chassis numbers for standing vehicles, future work

can be extended to identify engraved numbers for vehicles under motion conditions.

VII. LIMITATIONS

Despite of the advantages of our technique for engine and chassis number recognition, this technique has some limitations. As our database increases with more number of vehicle images, great care has to be taken during storage of these images. If vehicle is stolen and the theft interchange the engine or chassis number with other vehicle instead of changing the number plate as happens in most of the cases, it becomes difficult to identify the vehicle.

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