Vehicle Number Plate Recognition (VNPR) Using Improved Character Segmentation Method

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Abstract: ―

Invented in 1976, Number Plates Recognition (NPR) has since found wide commercial applications, making its research prospects challenging and scientifically interesting. A complete NPR system functions by vz steps, license plate; localization, sizing and orientation, normalization, character recognitions and geometric analysis. This paper is a review of NPR preliminary stages; it explains number plate localization, sizing and orientations as well as normalizations sections of the Number Plates Detection and Recognition-Tanzania Case study. MATLAB R2012b is employed in these processes. The input incorporated includes front and rear photographic images of vehicles, for proximity and simulation purposes the ample angle of image is 90 degree +-15. The captured image is converted to gray scale, binarized and edge detection algorithms are used to enhance edges. The output of this stage provides the input feature extraction, segmentation and recognitions.

Keywords: gray scale; thresholding; edge detection; algorithms; number plate; extraction

1. Introduction:

The vehicle number plate is a numeric or alphanumeric code that uniquely identifies the vehicle within the issuing country database. It is a metal or plastic plate attached at the front and /or rear of a motor vehicle. Being unique for every car, the number plate is an important resource for accessing particular data of the owner from the country information systems. In the United Republic of Tanzania we have varieties of number plate's registration standards as shown in fig1.0 below. This research is focused on designing algorithm(s) to serve the private and commercial feature to automate number plates that are used in Tanzania Mainland only. Furthermore the design criteria is limited to yellow and white commercial and private numbers, this automatically excludes vehicles with diplomatic ties in Tanzania i.e. green and blue. The main goal of this research is to study, analyze and design an efficient and optimized algorithm(s)

for detection and recognition of Tanzanian cars by their plate numbers. The algorithm(s) will provide accurate and timely alphanumeric recognition performance. The application of the algorithm(s) will facilitate automation capturing and recognition of vehicle plate number, additionally the license plate characters will be captured with information available in respective database, example Tanzania Revenue Authority database or parking lot database. Tanzania population has double since 1988, with a current estimated population of 48 Million [1], the vehicles for personal/ public and business means of transportation has largely increased. The significance of this study lies in the ability to minimize human involvement meanwhile aiding laws enforcement agents,, road toll data collection processes and can set a ground for other automated systems such as automated gate controls for authorized/ non-authorized vehicle and record keeping for entry and exit time.

Numerous image processing algorithms are available. These algorithms are customized to particular conditions, examples variations distributions of character spacing, plate color and ratios of dimension standards [2]. This has made it difficult to have same algorithm all over the world. Also, the available algorithms suffer from problems the robustness, stability, accuracy and convergence speed limitations. This research work to minimize these challenges, and in the process improve the accuracy and convergence speed of recognition rate. Inherently this will maximize the efficiency and performance of detection and recognition algorithms.

2. Literature reviews A vehicle number plate detection and recognition (VNPDR) is an applied image processing algorithms to identify vehicles registration numbers automatically by reading their number plates [3] This technology is a relatively new in Tanzania, but has been used since the 1980s in Europe (especially United Kingdom) to prevent crimes from vehicle theft to terrorism [4, 5]The VNPDR has become most important because of its applications like speed control, road traffic, toll collections, security and entrance-admissions. Much research has been done in China, Europe, USA, India, Malaysia, in Middle East, Kenya [4-7]. VNPDR is a challenging research area its complexity increases due to lack of standardizations between the number plates of different countries. The variations occur in shape, size, color, texture or orientation of number place region of the image. [3, 8, 9] In recent years, this technology of number plate recognition has increased popularity in security, traffic control and monitoring applications. Technically, the technology is sounding research topic because enormous discoveries of

computers and sophisticated high resolution infrared cameras. This make easier for image processing techniques more applicable analyzing and extracting important features for plate numbers detection and recognitions [10, 11]) The License Plate Localization and Recognition for Tanzania Car Plate Numbers was proposed in [11], where Sobel operators were used for edge detection. The sobel command performs a two dimensional spatial gradient measurement on an image. Sobel edge detector uses a pair of 3x3 convolution masks. Normally Sobel operator is used to find the approximate absolute gradient magnitude at each point in an input image which is the gray scale image, [5, 12].

Actually, the sobel masks is the oldest technology of image processing and does not provide good result for edge detection when considering in accuracy, stability, and robustness of the algorithms. [13] proposed a morphological image processing method. This method deals with edge analysis for number plate detection. Despite the fact the algorithm gives convincing results, in a sense of providing strong edge information. The car images which contain dark characters on light background can be used as an indication to detect the number plate, but it doesn't perform well in complex scenes. Morphological method can make all the required areas visible, but their shape may not be correct. On the other hand, for wider interval of levels the shape of required areas is correct but on the binary image there exist some unnecessary and unwanted elements [5, 10]. In additional, the method involves complex arithmetic which makes the computation process slower. Also, we have other logarithms using Artificial Neural Network and on multiple layer back propagation of neural networks, whereby Hough transforms was applied to find the boundary box of a number plate in spite of characters [3, 4, 6]. Despite the fact that,

technique being very sensitive to deformation of boundaries of the image, it encounters some difficulties in extracting the plate regions when the boundary of the plate surface is not clear due to damage or dirt. It should be noted that dirt/dust/physical deformation of number plates is common in Tanzania due to underdeveloped infrastructure of roads. [14]. In this literature challenges rises between two critical factors required in recognition algorithms; these are; accuracy and time divergence for system performance. Therefore compromise is needed to solve this bottleneck above problems [15] whereby, two methods of single and multilayer back propagation neural network back propagation were used to tackle them. Vehicle number plate detection and recognition algorithms work based on assumptions made. Ultimately developed algorithms have advantages and disadvantages, how to weigh advantages and disadvantages to get the level of accuracy and robustness required depend on assumptions. Due to the varying characteristics of the license plate among countries/regions further research is still needed in this area [16].

3. An overview of proposed algorithms This section gives an overview of the techniques employed to design the algorithms of vehicle number plate detection and recognition. Image processing involves signal processing, processes in which an input image is subjected to standard and /or customized signal-processing techniques. In the context of this research, the front/rear images of a car are processed to improve the pictorial information for automatic recognition of number plate's details for human interpretation. Image processing involves pre-processing, basically this includes intensity normalization and low frequency background noise reduction figure 2 below shows the general overview of the adopted design processes.
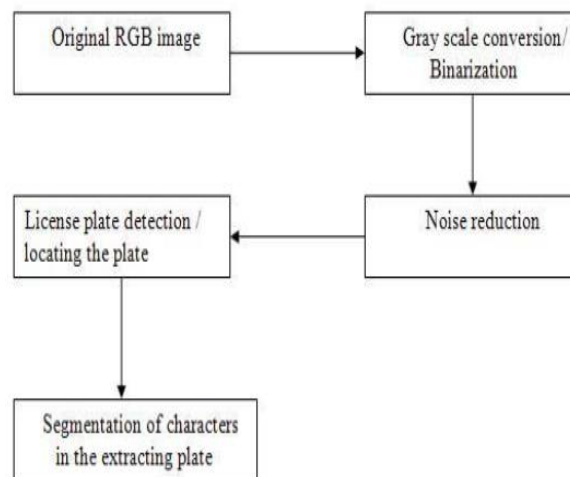
A. Input raw image

B. Gray scale conversion :- From the input RGB image it has to be convert to gray scale and the 8-bit gray value is calculated.

C. Noise reduction :- We used median filtering technique to reduce the paper and salt noise. We have used 3x 3 masks to get eight neighbors of a pixel and their corresponding gray value.

D. Contrast enhancement using histogram equalization:- Using histogram equalization technique the contrast of each image is being enhanced.

E. Plate localization:- The basic step in recognition of vehicle number plate is to detect the plate size. In general number plates are rectangular in shape. Hence we have to detect the edges of the rectangular plate. Mathematical morphology will be used to detect that region. Using Sobel edge detector we used to high light regions with a high edge magnitude and high edge variance are identified. Depending upon the threshold value edge will be detected from the input image.

F. Character Segmentation Matlab toolbox function provides a function called regionprops(). It measures a set of properties for each labeled region in the label matrix. We use boundingbox to measure the properties of the image region. After labeling the connecting components, the region will be extracting from the input image

RELATED WORK S.Roy, A. Choudhury, J. Mukherjee. [1]The proposed a system to localization of number plate mainly for the vehicles in West Bengal (India) and segmented the numbers as to identify each number separately. This paper presents an approach based on simple and efficient morphological operation and sobel edge detection method. He also presents a simple approach to segmented all the letters and numbers used in the number plate. After reducing noise from the input image we try to enhance the contrast of the binarized image using histogram equalization. We mainly concentrate on two steps; one is to locate the number plate and second is to segment all the number and letters to identify each number separately. S. Du, M. Shehata, W. Badawy [2] Describe a comprehensive survey on existing (Automatic License Plate Recognition)ALPR Techniques by categorizing them according to the features used in each stage. Comparisons of them in the terms of Pros, Cons, Recognition results, & Processing speeds were addressed. A future forecast for ALPR was also given at the end. The future research of ALPR should concentrate on multistyle plate recognition, video-based ALPR using temporal information, multiplates processing, high definition plate image processing, ambiguous-character recognition. P.anishiya, prof. S. Mary joans [3] focused a number plate localization and recognition system for vehicles in Tamilnadu(India) is proposed. This system is developed based on digital images and can be easily applied to commercial car park systems for the use of documenting access of parking services, secure usage of parking houses and also to prevent car theft issues. The proposed algorithm is based on a combination of morphological operation with area criteria tests for number plate localization. Segmentation of the plate characters was achieved by the application of edge detectors, labeling and fill

hole approach. The character recognition was accomplished with the aid of optical characters by the process of Template matching. S. H. Kasaei .,S. M. Kasaei [4] Presented a novel method of identifying and recognizing of Iranian car license plates. Firstly we extracted the plate location, and then we separated the plate characters by segmentation and applied a correlation based template matching scheme for recognition of plate characters. This system is customized for the identification of Iranian license plates. The system is tested over a large number (more than 150) of images, where this algorithm performs well on different types of vehicles including Iranian car and motorcycle plates as well as diverse circumstances. Finally it is proved to be %97.3 correct in the extraction of plate region and %94 correct in the segmentation of the characters and %92 in the recognition of the characters. He believe that this system can be redesigned and tested for multinational car license plates in the future time regarding their own attributes. D. Jiang,T. M. Mekonnen,T. E. Merkebu,A Gebrehiwot.[5] Discussed paper presents about car plate recognition system.it describes, design algorism and future of implementation. The system has color image inputs of a car and the output has the registration number of that car. The system has three main steps to get the desired information. Those are plate localization, character segmentation and character recognition. First, the number of plate is extracted from the original image, then the characters from it are isolated, and finally each character is recognized. The algorithms were developed using a set of training images. The final program is capable of extracting the desired information in a high percentage of the test images. Z. Xu., H. Zhu.[6] Presented an efficient and robust method of locating license plate is presented. The method makes use of the rich corner information in the plate area and the

edge information of license plates. It can deal with more difficult location problems, especially with a license plate existing in a complicated background.

CONCLUSION From review of various paper we conclude that there are different techniques are available for recognition of car number plate. Sobel edge dection method,Automatic license plate recognition, Novel method used for detects edge & fill holes less than 8 pixels only, categoring features in each stage ,identifying & recognizing car license plate. Therefore at this stage use of improved character segmentation method to reduce effort required for recognizing vehicle license number plate. Try to Calculate improve result as compare to conventional method in turn of time require for convergence.

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