International Journal of Synergy in Engineering and Technology
IJSET

Accuration detection and recognition of vehicle plate numbers for high speed using QR code

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KEYWORDS

Quick Response Code
QR Code
2d Barcode
Windshield
Car
Vehicle

ABSTRACT

QR Code is becoming popular and extensive adoption in international especially in Japan and Korea. Recent statistic from several agencies revealed that more than 96% people who are using QR Code scanning to visit Internet accounts. The main purpose of created QR Code is a scanning item from the warehouse and now moving forward to use on newspapers, magazines, journals, websites, advertisement, store websites address, content information and miscellaneous data. Yet, most companies are still confused about the concept of QR Code even though they follow the market trend spending using QR Code. Conversely, This paper, we propose a movement object system recognition using QR code attached to a windshield. The experiment was done by recording a video file, while the car was moving at various speeds. From the experiment results, the identification success rate of 100 percent was achieved when the car moving less than 30 kilometers per hour. At the speed of 60 kilometers per hours, the identification of rate is 30 percent successful. This paper enhances the contrast of the grayscale image by transforming the values using Contrast Limited Adaptive Histogram Equalization (CLAHE).

1.0 INTRODUCTION

QR Code (abbreviated from Quick Response Code) is the trademark for a type of two dimensional code that designed for automative industry. QR Code was invented by the Toyota subsidiary Denso-Wave in 1994[1]. Recently, QR Code has been popular in Mobile Internet and the Internet of Things due to its fast readability and large storage capacity. Compared to the Universal Product Code (UPC) or barcode, QR Code obtains higher fault tolerance and the ability

Received 20 June 2020; received in revised form 10 July 2020; accepted 25 July 2020.

of error correction. Nowdays, QR Code has being increasingly widely used around the filed of e-commerce, electronic card and social network services.

Primarily, the researchers doing on QR Code detecting and image pre- processing methos based on rotated interpolation and Hough Transform. According to Jun Li adopting Hough transform based on edge detection and deforminity correction as image pre-processing [2]. Tingting Huang proposed a method that improved the Hough transform and noise filtering as image processing [3]. Ming Sun proposed a method that improved the adaptive algorithmn and hollowed contain to get code edge for Hough transform.

Nonetheless, the recognition rate all of these method is not perfect. There are analyze two problems with their existing project. Firstly about the rotation and interpolation can bring on additional image distortation. Secondly, Hough transform algorithm is an effective way to get the roght edges of QR Code but is computationally expensive. However, this paper, we propose an image processing detection using QR Code based on movement object. We are focused on the detection for vehicle plate number using CLAHE [4]. The existing QR Code decoders require the symbol to the properly "framed", that is the symbol must correspond to at least 30% of the image area to be suitable for decoding [4]. Often, even images acquired with the specific intent of capturing a QR Code are subject to noise, blur, rotation, perspective distortation, uneven illumination, or partial code are occlusin. Decoders may failed due to such as noise and distortations. Therefore, most researcher in related literature, concerned with barcode detection or recognition, deal with the problem of enhancing or processing these types of the images in order to facilitate decoding. According to Watsama Hogpracha and Sartid Vongpradhip, the detect of image using QR Code used in record video using camera.

They are using Contrast Limited Adaptive Histogram Equalization (CLHAE) for detect the images [1]. Most researcher proposing the use of these codes to help visually impaired and blind people do not address the problem of getting a person with this kind of disability to correctly point the camera towards the barcodes symbol. However they do acknowledge that processing arbitratry acquired images for the detection of 2D barcodes and development of computationally efficient algorithms to recognize the barcode symbols in low light and low resoluton situations are challenging and relevant issue [1]. [5]

According to [6], Qr Code can be detected based on the movement object when the object has been attached. Qr Code can be save all information in the different part and angles. Structure above shown the details of QR Code. It is defined in the following way in the QR Code specifications such as : The region 4X wide which shall be free of all others markings, surrounding the symbol on all four sides. There are divide a few section [7].

Section A

The finder pattern consists of three identical structures the are located in all corners of the QR Code expect the bottom right conner[8]. Each pattern is based on a 3 X 3 matrix of black modules surrounded by white module that are again surrounded by black modules. 3 X 3 matrix of black modules surrounded by white modules that are again surrounded by black modules.

Section B

The white seperators have a width of one pixel and improve the recognizability of the Finder Patern as they seperate them from the actual data. While, Timing Pattern enable the decorder software to determine the width of a single module.

Section C

Alignment pattern support the decoder software in compensating for mederate image distortions. Version 1 QR Code do not have alignment patterns.

Section D

The format Information section consists of 15 bits nect to the seperators and stores infromation about the error correction level of the QR Code and the chosen masking pattern.

Section E

Data is converted into a bit stream and then stored in 8 bit parts (called code words) in the data section.

Figure 1: Examples of QR Code and Plate Number

A. Size and position of QR Code

QR Code attached to the left side of the whindshield. The size of QR Code is 9 cm X 9 cm. That size is suitable for the camera recorded and detecting QR Code. See Fig 2: The camera was static and stand the left side of the road. When the car move around speed that we are set, the camera has automatically recorded. See Figure.

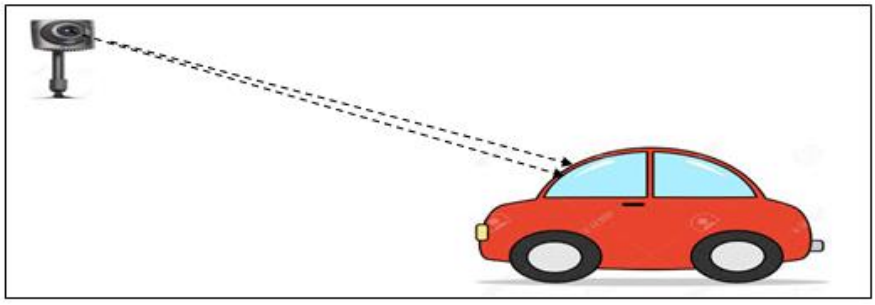

Figure 2: Camera and Car Positions

B. Outline of Process

First step, user load a video file and system that has been recorded into the Contrast Limited Adaptive Histogram Equalization (CLAHE). The main objective for step is:

1) Adjust the image intensity values. Convert frame video image to grayscale image then adjust the data saturated either low or high intensities of grayscale image. This can be increasing the contrast of the output image.
2) Contrast limited adaptive histogram equalization is for enhances the contrast of the grayscale image and transforming the values using (CLAHE).
3) Convert image to binary image based on threshold. The output binary image replaces all pixels in the input image with luminance greater than level with the value and

replaces all other pixels with the value black. Basically, we are set the level 0.5 for the midway between black and white but we specify level in the range [0, 1] to 0.7.

After pre-processing step done, QR Code read the data from binary image and shows the message to user. If QR Code can read, the system will be count to the next frame and repeat to pre-processing step again. The message will be displayed "NOT FOUND QR CODE" if second frame not function.

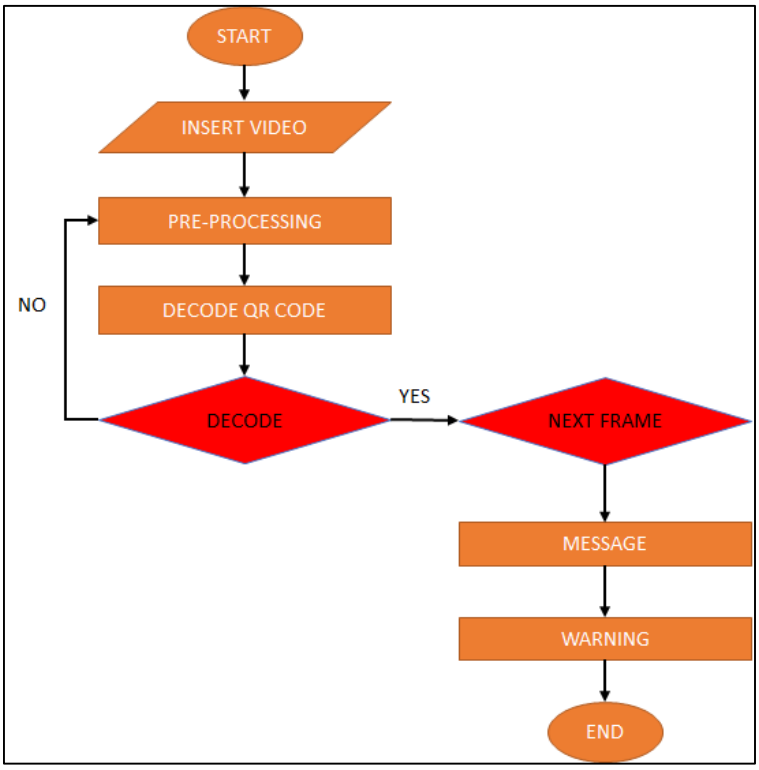

Figure 3: The Process of QR Code Recorded

C. Grayscale image

Grayscale images are without color, or achromatic images. The standard of grayscale ranges from 0 (black) to 1 (white). After calculating the histogram, images are converted into gray scale images to reduce the complexity while applying the morphological operations. Fig 4 the original image before convert to CLAHE. QR Code normally attach on the left side. Fig 5. The experiment result that enhances the contrast of the grayscale. While Fig 6 image after use CLAHE [9].

Figure 4: QR Code Position

Figure 5: Before CLAHE

Figure 6: After CLAHE

2.0 METHODOLOGY

QR Code (abbreviated from Quick Response Code) is a high capacity encoding of data. Compared to conventional bar codes can handle several hundred times more information. QR Code can handle all types of data such as numeric and alphabetic, Kanji, Kana, Hiragana, Symbols, Binary and control codes. Up to 7,089 characters can be encoded in one symbol.

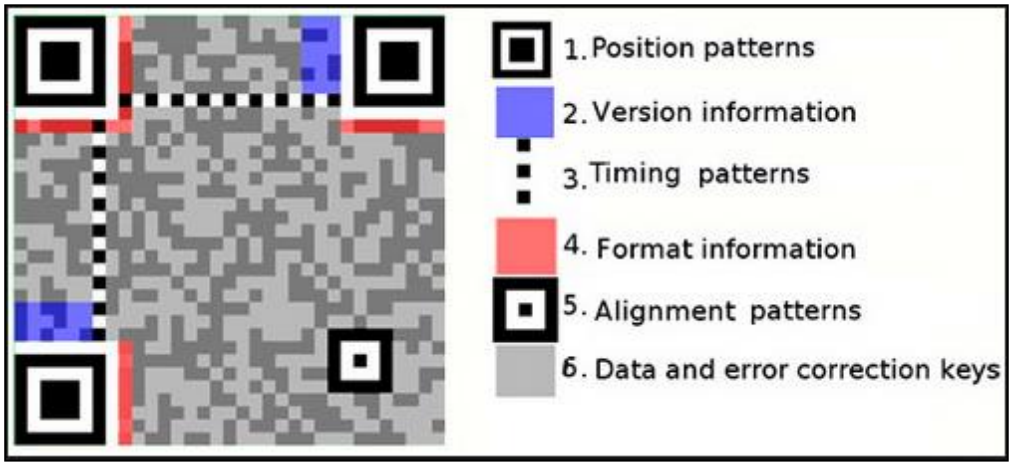

Figure 7: Size and Position of QR Code

The effectively scan the QR Code it should to be at least 1cm (0.4 inches) across in the viewport of the scanning device and as the distance between the camera and the QR Code increases. The size of QR Code will need to increase to compensate. For this research, QR Code size is 21 X 21 – 177 modules and the size become grows by 4 modules/ side. The type of amount of data is numeric, Alphanumeric, 8- bit bytes (binary) and Kanji. QR Code error correction divides a few levels to detect correction [10]. Four error correction levels are available for users to choose according to the operating environment. Raising this level improves error correction capability but also increases the amount of data QR Code size. Level Q or H may be selected for factory environment where QR Code get dirt, whereas Level L may be selected for clean environment with the large amount of data. Finally, Level M (15%) is most frequently selected.

The density of the code is described by a version number that is based on the number of rows and columns of dots. A version 1 QR Code will have 21 rows and 21 columns of dots and the version number will then increase by 1 for every 4 extra rows and columns [11].

Table 1: Error Correction (Data Restoration rate)

Level L	Approx. 7%
Level M	Approx. 15%
Level Q	Approx. 25%
Level H	Approx. 30%

3.0 RESULTS AND DISCUSSION

We implemented our method using Contrast Limited Adaptive Histogram Equalization (CLHAE) platform. We recorded more than 15 videos and different speed and agle by mobile phone.

Table 2: Recorded video and speed limits

Km/hrs	Read	Videos Recorded
0-30	yes	20 videos
35	yes	18 videos
40	yes	10 videos
45	yes	16 videos
50	yes	10 videos
55	yes	8 videos
60	yes	3 videos

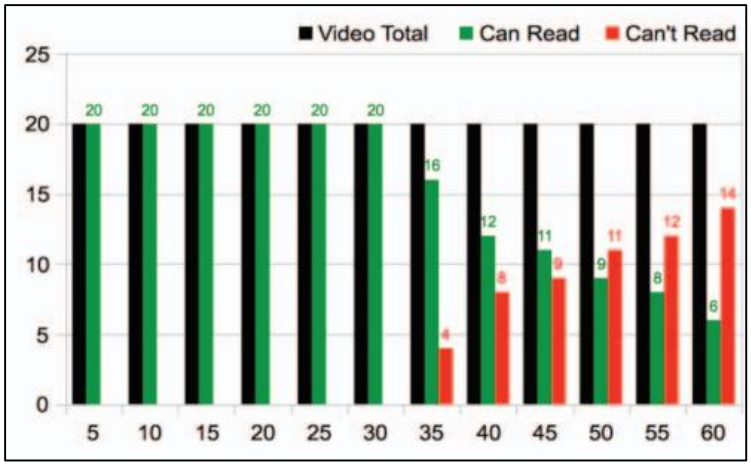

Figure 8: Experiment Results

From the experiment results, the identification success rate of 100% was achieved in different speed. At the spped of 35km/hr, the identification success rate is 80%. At the speed of 40km/hr, the identification success rate was 60 percent. While the speed at 45 km/hr, the identification success rate is 55 percent. However, at speed of 50km/hr, the success rate is 45 percent. Following of speed at 55km/hr the success rate was 40 percent. The last is 60km/hr the identification success rate was 30 percent. Refer figure below:

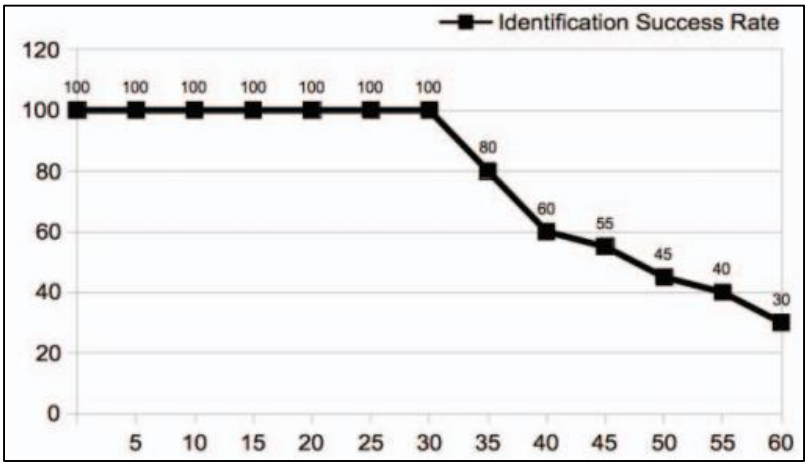

Figure 9: Identification Success Rate

4.0 CONCLUSION

We purpose a system to detect a movement object using QR Code scanner with different speed. QR Code attached on the left side windshield. After the vehicle move on around the speed limits, the QR Code can be detected. This system consists of processing as grayscale, CLAHE, binary image and decoding the QR Code. QR Code also identifies from the low speed to highest speeds. Even the slowest, fastest of a moving is detected accurately by selecting the proper threshold value of the objects. Finally, this QR Code works for real time with video processing and its computational complexity is high. Future work will be increasing the detection of movement object with QR Code with highest speed limits.

REFERENCES

[1] A. Singh and D. P. Singh, "a Review : Qr Codes and Its Image Pre-Processing Method," Int. J. Sci. Eng. Technol. Res., vol. 5, no. 6, pp. 1955–1960, 2016.
[2] Z. Yao and W. Yi, "Curvature aided Hough transform for circle detection," Expert Syst. Appl., vol. 51, pp. 26–33, 2016.
[3] T. Huang, J. Wang, F. Duan, J. Jiang, X. Fu, and X. Xu, "A simple algorithm for the implementation of second-order-polynomial based peak-tracking methods," Opt. Fiber Technol., vol. 47, no. September 2018, pp. 192–196, 2019.
[4] D. K. Hansen, K. Nasrollahi, C. B. Rasmusen, and T. B. Moeslund, "Real-Time Barcode Detection and Classification using Deep Learning," Proc. 9th Int. Jt. Conf. Comput. Intell., pp. 321–327, 2017.
[5] S. Shome and S. Vadali, "Enhancement of Diabetic Retinopathy Imagery Using Contrast Limited Adaptive Histogram Equalization," Ijcsit.Com, vol. 2, no. 6, pp. 2694–2699, 201
[6] S. Majumdar, B. A. M. Bhattacharyya, and D. A. Nath, "Advanced Security Algorithm Using QRCode TM Implemented for an Android Smartphone System : A _ QR," vol. 7782, pp. 21–31, 2015.
[7] N. Soman, U. Shelke, and S. Patel, "Automated Examination Using QR Code," Int. J. Eng. Adv. Technol., vol. 2, no. 3, pp. 622–627, 2013.
[8] "QR code.com." [Online]. Available: https://www.qrcode.com/en/faq.html. [Accessed: 04-Feb-2019].
[9] L. F. F. Belussi and N. S. T. Hirata, "Fast QR code detection in arbitrarily acquired images," Proc. - 24th SIBGRAPI Conf. Graph. Patterns Images, pp. 281–288, 2011.
[10] J. Rouillard, "Contextual QR codes," Proc. - 3rd Int. Multi-Conf. Comput. Glob. Inf. Technol. ICCGI 2008 Conjunction with ComP2P 2008 1st Int. Work. Comput. P2P Networks Theory Pract., pp. 50–55, 2008.
[11] H.-K. Chu, C.-S. Chang, R.-R. Lee, and N. J. Mitra, "Halftone QR codes," ACM Trans. Graph., vol. 32, no. 6, pp. 1–8, 2013.

