

Evaluation of License Plate Image Quality and Character Recognition at varying Distance Using Amped FIVE

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ABSTRACT

The Vehicle license plates constitute an important source of information for vehicle identification and are frequently encountered in forensic investigations, traffic surveillance, road-accident investigations, vehicle theft cases, and other law-enforcement applications. and cases related like hit and run, illegal trafficking, road accidents etc. the license plate examination are an important source of evidence form vehicle identification in forensic investigations, their evidential value can be affected by the distance, quality, distortion and visibility. This study aimed to evaluate CCTV camera to vehicle distance on license plate image quality and character recognition. The study analyzed license plate image of both two and four wheelers at the three different distances (3 ft, 5 ft and 7 ft) the extracted images were examined and enhanced using Amped FIVE, a forensic image and video analysis software. The evaluation was based on sample extraction, character visibility, character readability, image clarity, distortion, and enhancement quality. This study provides useful insights for the forensic examination of surveillance and traffic monitoring images for vehicle license plate identification.

Keywords: License plate, forensic image analysis, character recognition, camera-to-vehicle distance, digital evidence

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INTRODUCTION

The examination of vehicle license plates is an important source of information for vehicle identification and are frequently encountered in the time of investigations, hit and run cases, traffic managements, road accident investigations, vehicle theft cases and other applications. The examinations of license plates are based on the detection of license plate region followed by recognition and extraction of the characters, also demonstrated that enhancement and super-resolution techniques can improve the recognition of blurred and low-quality license-plate images. [1-3] the distance between the vehicle and the surveillance play an important factor influencing license plate image quality. If the distance increases, the license plate occupies a small region of the image and the number of pixels available to represent individual character decreases. Resulting in reduced visibility and readability [3,4] the image enhancement technique becomes an important component of the LPR analysis. Recent studies have further emphasized the importance of recover characters information from degraded license plate images [5,6]

The forensic examination is different from the The study consisted of a total 60 samples,

automated recognition because the examiner not only obtain a readable result but also analyses and evaluate the quality interpretability of the processed image.

METHODOLOGY:

This study uses a controlled experimental design to investigate the effect of surveillance and distance variables on license plate analysis. the image was evaluated using different parameters like sample extraction, character visibility, character readability, image clarity, Distortion, enhancement quality by 2.4-megapixel outdoor camera at height of 3ft, 5ft and 7ft and then the DVR recorded video were used to extract frames through VLC media player after that Image Processing was done by using Amped Five

Sample collection

Vehicle license plate images were collected from surveillance under controlled environmental conditions. Two categories of vehicles were considered.

Four-Wheeler and Two-Wheeler

For each category, images extracted at three different cameras to vehicle distances. 3ft, 5ft and 7ft

Type	3 ft	5 ft	7 ft	Total
Four-wheeler	40	40	40	120
Two-wheeler	20	20	20	60

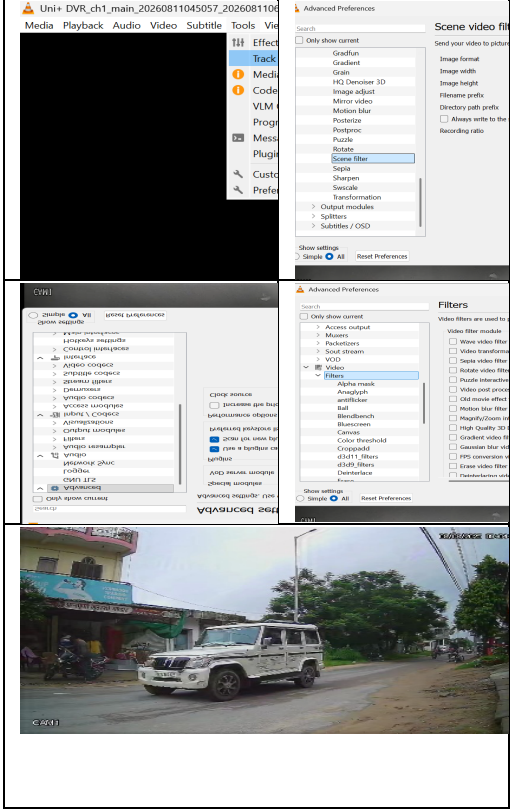
VLC player image extraction:

Video acquisition → Open with VLC → Tools → All preference → filter → Scene filter → Select path and ratio → Save → video → Tick scene filter and save → Play

Image Processing Using Amped Five

Image acquisition → preservation → Image import into Amped FIVE → License-plate region identification → Image enhancement → Character examination → Quality assessment → Comparative analysis

Figure : 1



(VLC player image extraction)

Image Enhancement:

Amped FIVE processing operations used, Deblurring, where applicable, correct prescriptive, Brightness, exposure adjustment, Contrast adjustment, Sharpening, Noise reduction, Aspect ratio, Correct prescriptive



(Amped FIVE-Based Frame and Image Analysis)

RESULT'S AND DISCUTION:

The paper evaluates the effect of varying

camera to vehicle distance on licenses plate quality and recognition using Amped FIVE. Total sample size for two-wheeler is 20 and for four-wheeler is 40 at each height with total two-wheeler of 60 and 120 of four-wheeler.

Table: 1

Camera Height	Sample	Sample Extracted	Character Visibility	Character Readability	Image Clarity	Distortion	Enhancement Quality
3 ft	40	14 (35 %)	11 (27.5 %)	9 (22.5 %)	9 (22.5 %)	22 (55 %)	45 %
5 ft	40	7 (17.5 %)	4 (10 %)	4 (10 %)	4 (10 %)	32 (80 %)	40 %
7 ft	40	2 (5 %)	3 (7.5 %)	3 (7.5 %)	1 (2.5 %)	38 (95 %)	5 %

(Four-Wheeler

License Plate Analysis)

Table: 2

Camera Height	Sample	Sample Extracted	Character Visibility	Character Readability	Image Clarity	Distortion	Enhancement Quality
3 ft	20	6 (30 %)	3 (15 %)	2 (10 %)	2 (10 %)	18 (90 %)	10 %
5 ft	20	3 (15 %)	1 (5 %)	1 (5 %)	1 (5 %)	19 (95 %)	5 %
7 ft	20	2 (10 %)	1 (5 %)	1 (5 %)	1 (5 %)	19 (95 %)	5 %

(Two-Wheeler

License Plate Analysis)

The study demonstrated that 3 ft is the optimum distance among the distance evaluated for the license plate examination using Amped FIVE. Increasing the distance from 3ft to 7 ft resulted in reduced sample extraction, visibility, readability and quality enhancements, accompanied by increased distortion. The four-wheeler license plate showed better character recognition at greater distances as compare to two-wheeler license plates.

For four-wheelers, the 3 ft camera height produced the highest sample extraction rate, with 14 out of 40 samples (35%) successfully extracted. Character visibility was 27.5%, while readability and image clarity were 22.5% each. Distortion was observed in 55% of the samples, and the enhancement quality was 45%. At 7 ft, sample extraction decreased to 17.5%, character visibility and readability decreased to 10%, and distortion increased to 80%. At 7 ft, only 5% of samples were extracted, with character visibility of 7.5 %, readability of 7.5 %, and image clarity of 2.5 %. For two-wheelers, the 3 ft camera height also provided comparatively better results. Six out of 20 samples (30%) were successfully extracted, with character visibility of 15%, readability of 10%, and image clarity of 10%. Distortion was recorded in 90% of the samples. At 5 ft and 7 ft, sample extraction decreased to 15% and 10%, respectively. Character visibility remained at 10%, while distortion increased to 95%.

Othe findings indicate that lower camera placement, particularly at 3 ft, provided better license plate extraction and character visibility than the higher camera positions of 5 ft and 7 ft. However, the relatively high distortion observed in the samples indicates that camera height alone does not determine evidential quality. Factors such as viewing angle, distance, illumination, motion, plate orientation, and image resolution may also influence the ability to obtain readable license plate information

The result showcases a clear relationship between CCTV camera to vehicle Distance and License plate character recognition, As the distance increased from 3 ft to 7 ft, the percentage of successfully extracted samples, visibility, readability, and quality enhancement decreased, and distortion increased. At the 3 ft distance produced the most favorable results for four-wheeler compared to two-wheeler categories. At the 7ft the recognition performance was considerably reduced.

CONCLUSION

This study demonstrates that the distance between the camera and the vehicle has a significant influence on the quality and forensic interpretability of the images. Among the three distances evaluated, 3 ft produced comparative

high result. With an increase distance to 5ft to 7 ft a progressive reduction in sample extraction, character visibility, readability, and enhancement quality was observed. Overall, the Amped FIVE demonstrated usefulness for the forensic enhancement and examination if license plate image sample extracted had a good quality, the study highlights the importance of acquisition distance in obtaining interpretable license plate sample and useful in forensic investigations involving CCTV footage, traffic monitoring, surveillance images etc. Further studies using larger datasets, different high-resolution cameras, illumination conditions, different angles are recommended to validate and extend these findings.

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