SWE 342
TECHNICAL WRITING AND PRESENTATION

SEMESTER: 3/2, SOFTWARE ENGINEERING, SUST

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CONTENT

TITLE AND INTRODUCTION

“An Effective Method for the Recognition and Verification of Bangladeshi Vehicle Digital Number Plates”

AUTHORS AND AFFILIATION

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OBJECTIVE

In this study, an effective and automatic technique has been proposed to detect, recognize and verify Bangladeshi number plates

DATASET AND DATABASE

- Developed a dataset of 500 Bangladeshi number plate images for research

- Created a template dataset and cloud database for character recognition and vehicle verification

(a)

Vehicle Category	License Plate Colour	Character Colour	License Plates
Commercial	Green	Black	ঢাকা মেট্রো- ন ১৭-৫৩১৩
Private	White	Black	ঢাকা মেট্রো- ক ০৩-৬৪০৬

(b)

Fig. 1: (a) Sample of number plate for Bangladeshi vehicle, (b) Categories of vehicle

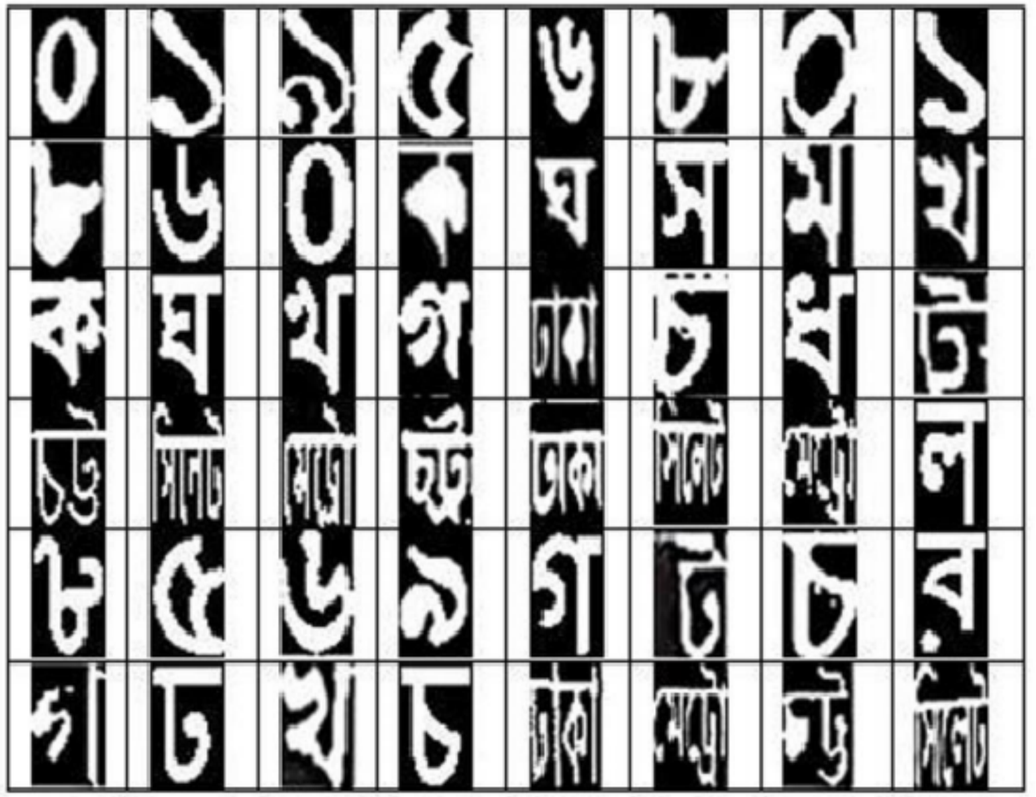


Fig. 2: Some samples of the templates

METHODOLOGY

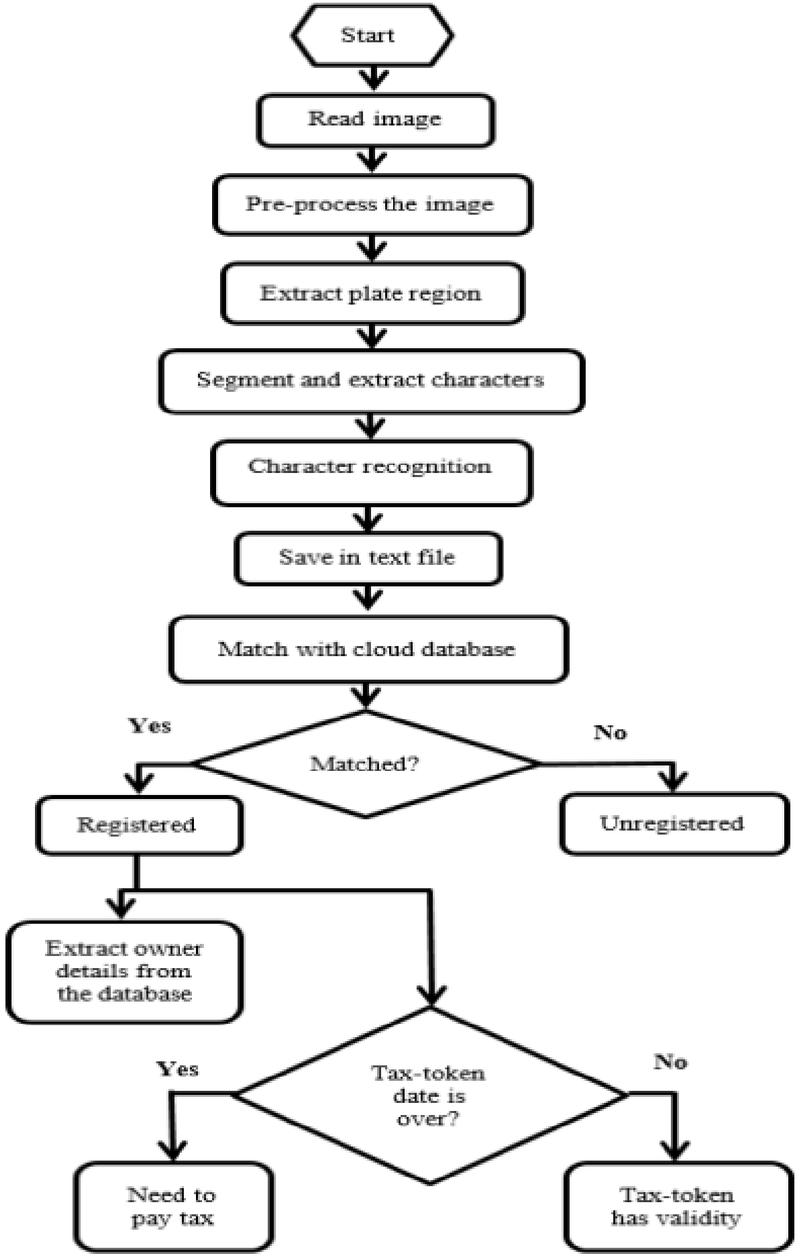


Fig. 4: Flow chart of the proposed method

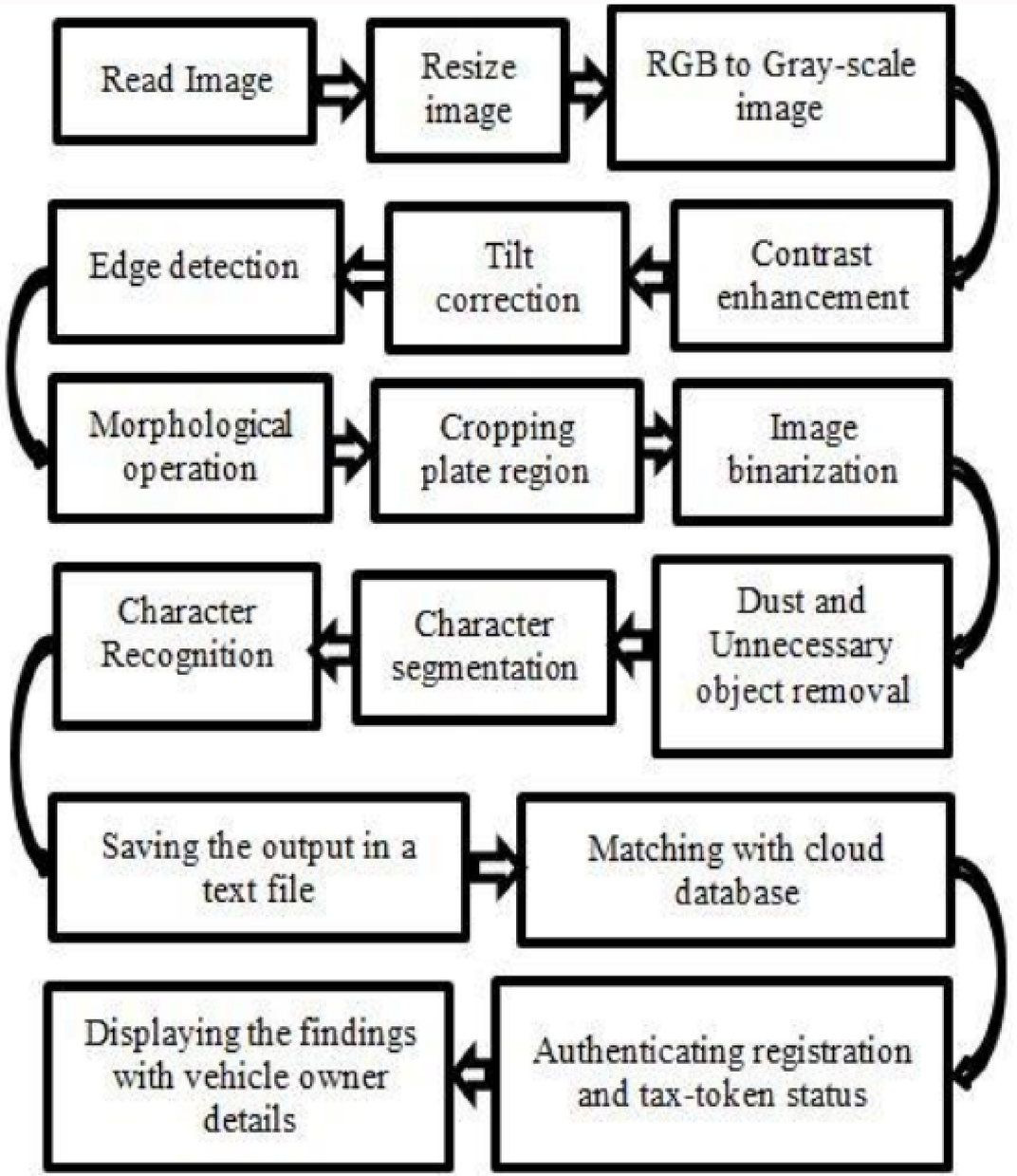


Fig. 3: Overview of the proposed method

METHODOLOGY

IMAGE PROCESSING

The input image is resized and converted to grayscale before undergoing contrast enhancement and tilt correction

EXTRACTION AND SEGMENTATION

Edge detection, morphological operations, bounding box method, and character segmentation

METHODOLOGY

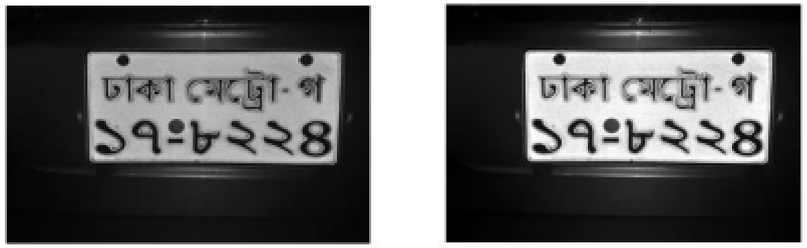
CHARACTER RECOGNITION

Template matching technique for recognizing Bangla characters and the results are stored in a text file

VEHICLE VERIFICATION

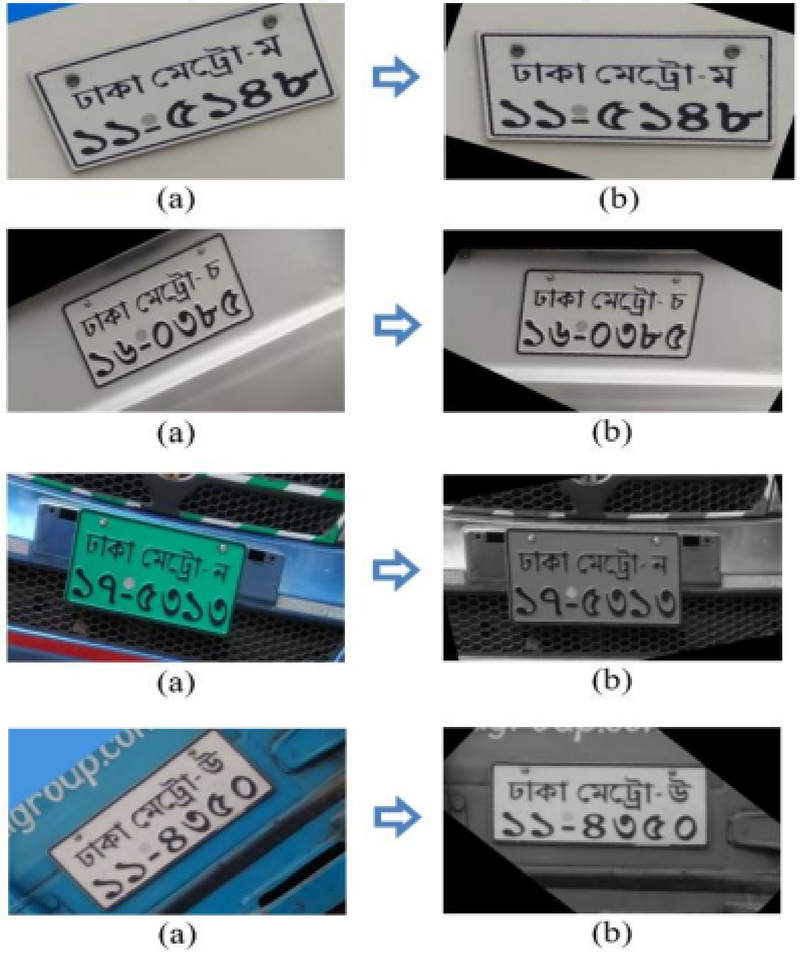
The text file is compared with a cloud database containing registered vehicle details. If a match is found in the database, the vehicle is marked as registered, and the system extracts owner details and checks the validity of the car's tax-token

IMAGE PROCESSING



(a) (b)

Fig. 5: Effect of contrast enhancement: (a) Before enhancement and (b) after enhancement



(a) (b)

(a) (b)

(a) (b)

(a) (b)

Fig. 6: Sample of some tilt corrected images: (a) Before tilt correction and (b) after tilt correction

EXTRACTION AND SEGMENTATION

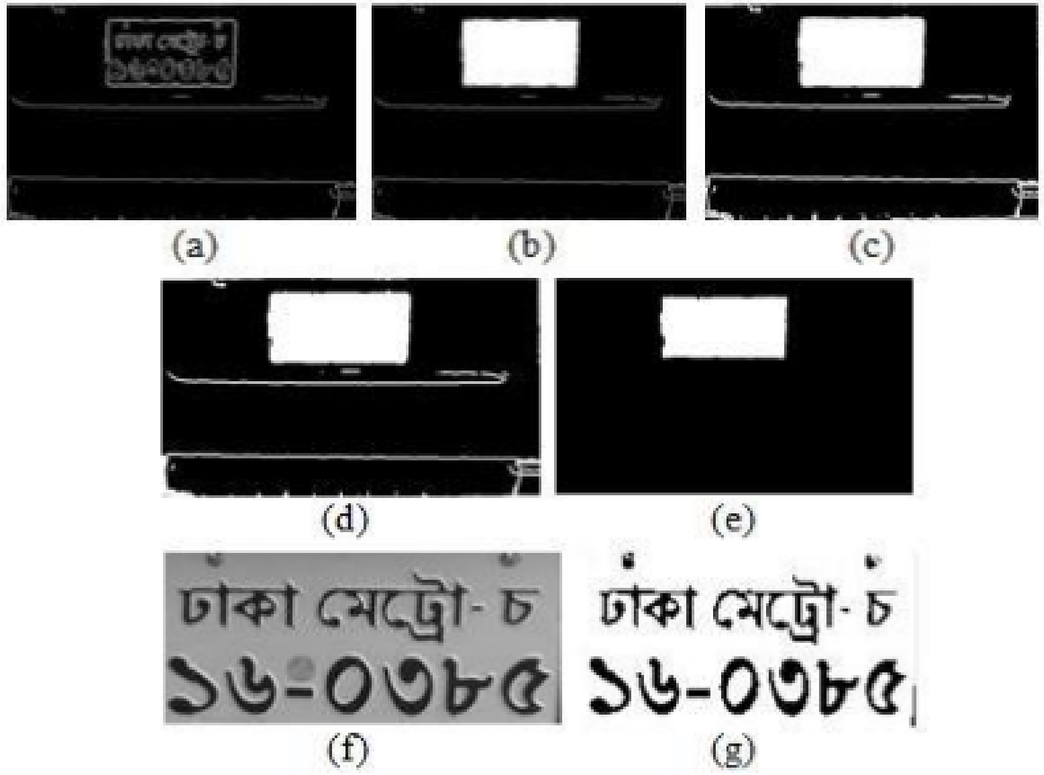


Fig. 7: Extraction process: (a) Sobel image, (b) filled image-1, (c) dilated image, (d) filled image-2, (e) final eroded image, (f) extracted plate image and (g) binarized image

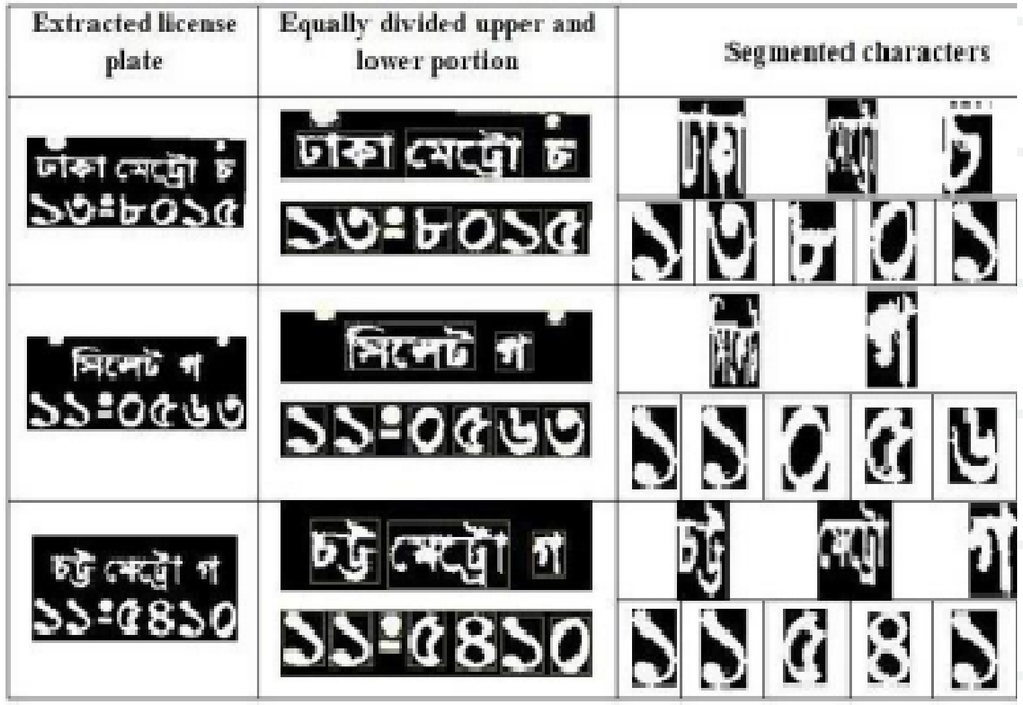


Fig. 8: Character segmentation process

CHARACTER RECOGNITION

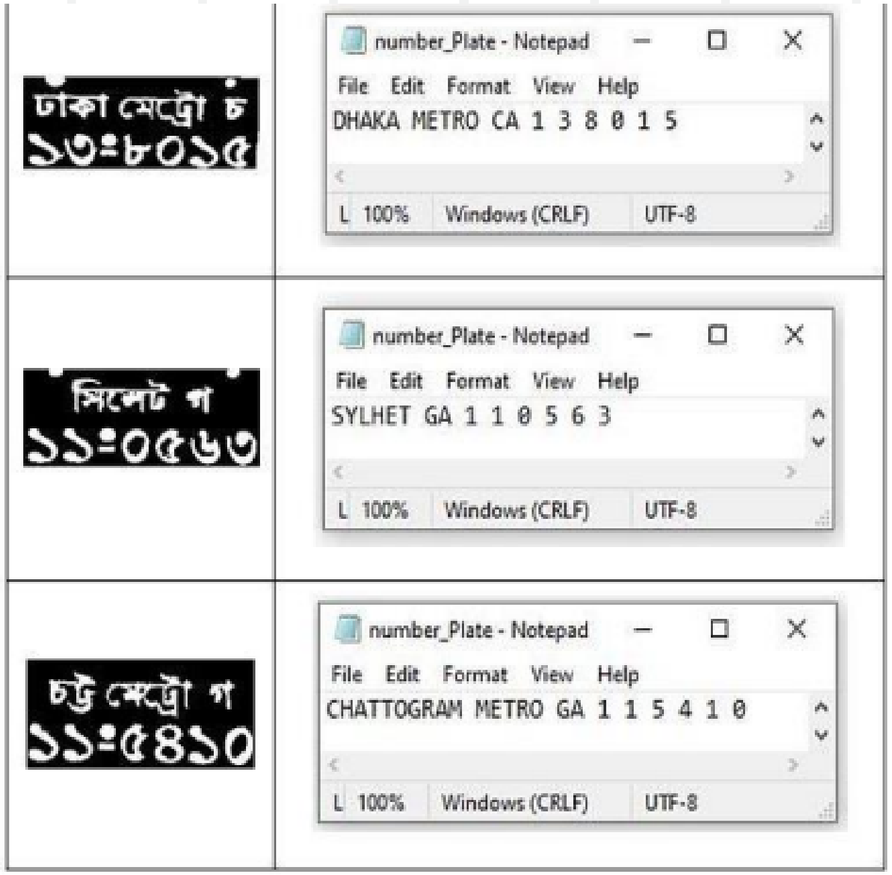


Fig. 9: Recognition of characters to text from the segmented characters

VEHICLE VERIFICATION

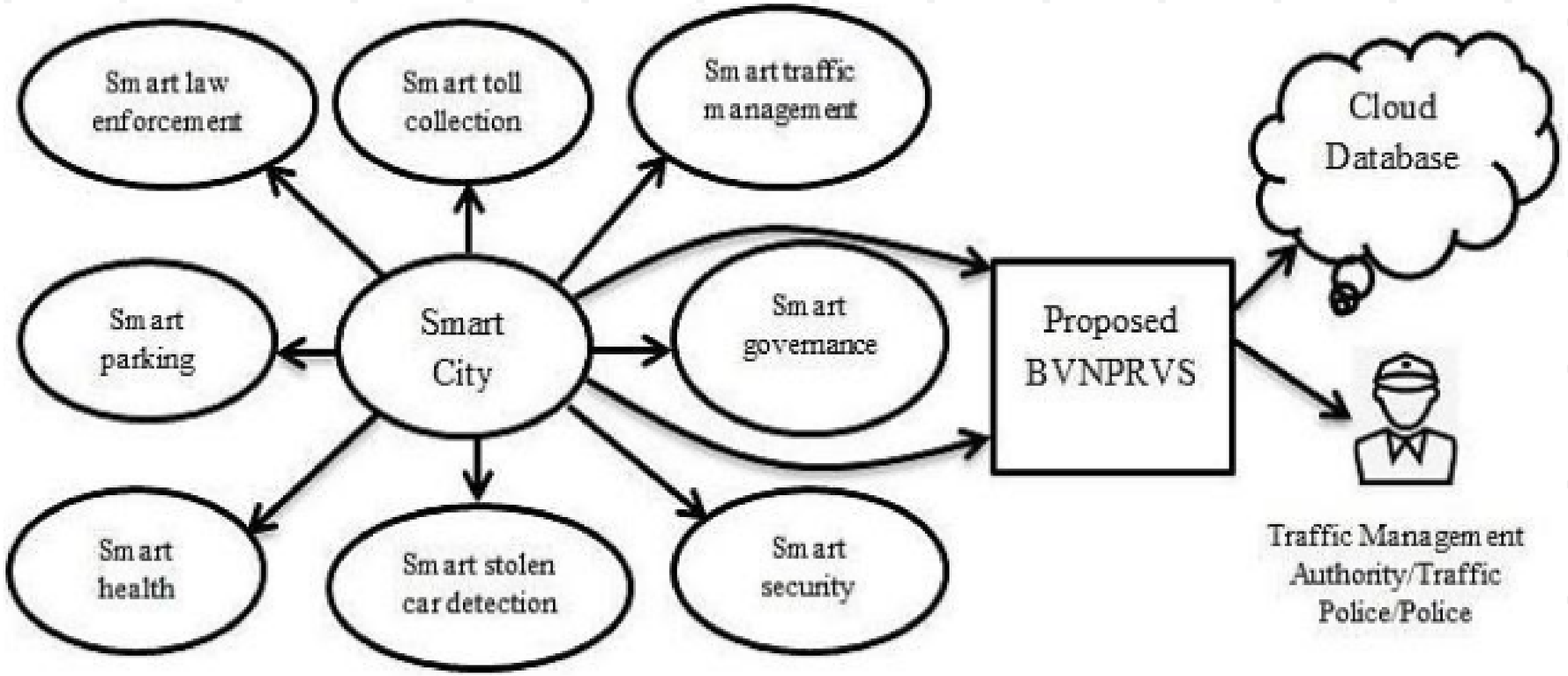


Fig. 10: Framework for the verification of a vehicle

VEHICLE VERIFICATION

Fig. 11: Generated message box if the vehicle is unregistered

VEHICLE VERIFICATION

Fig. 12: Generated message box if the vehicle is registered with a valid tax-token

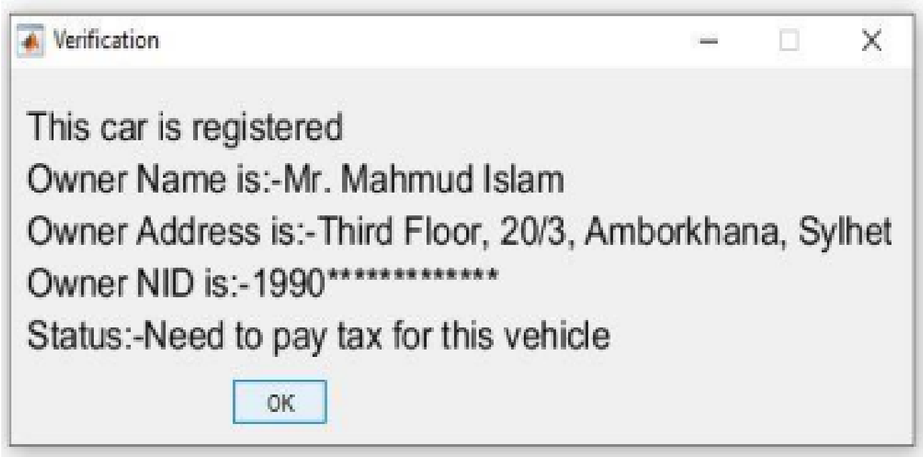
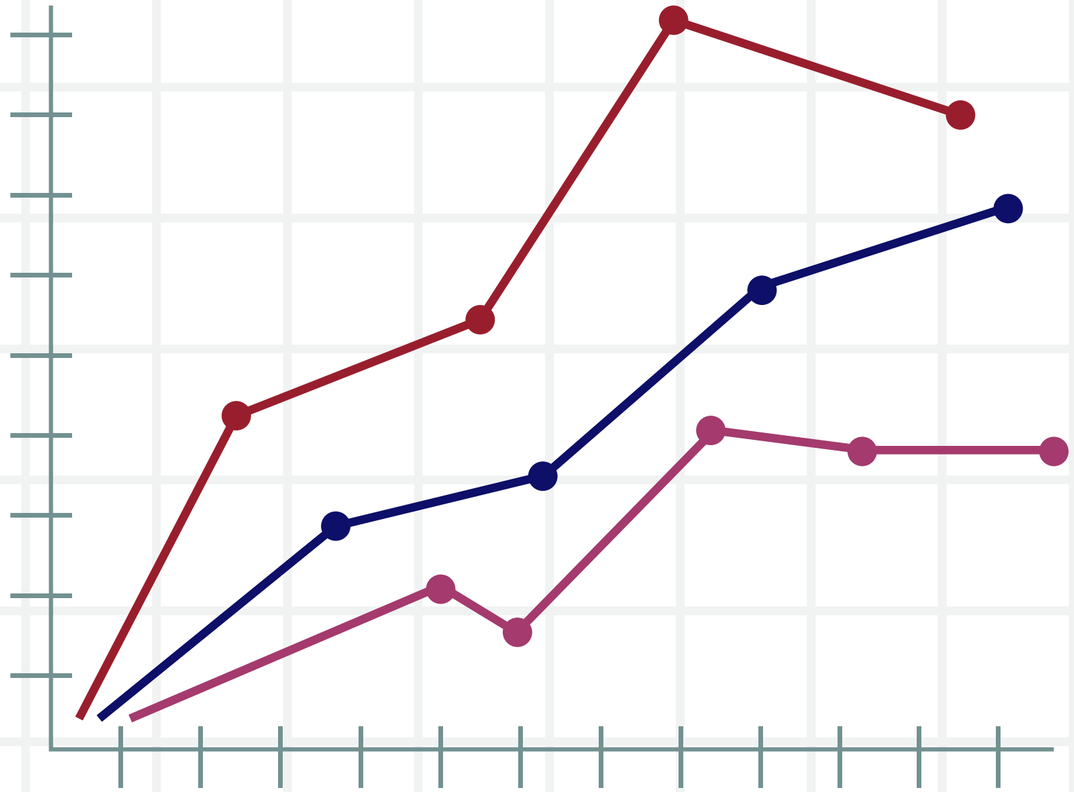


Fig. 13: Generated message box if the vehicle is registered but tax-token is expired

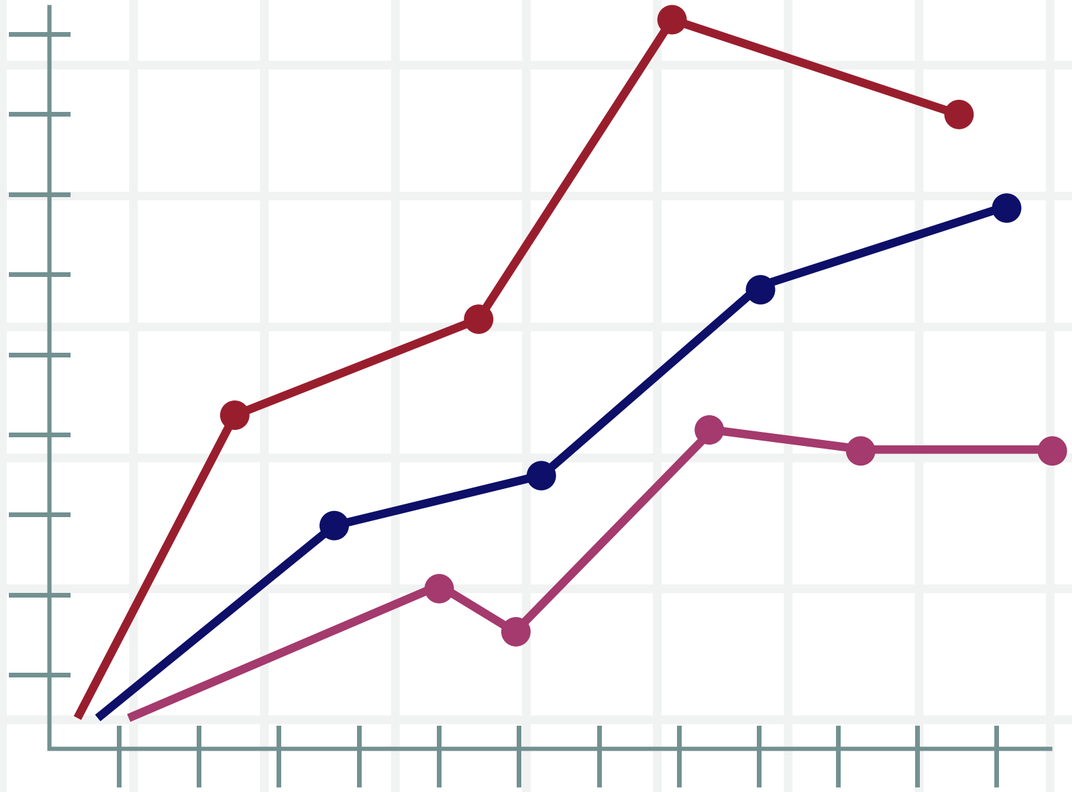
ACHIEVED ACCURACY

- Plate Detection: 96.8% (484 out of 500 plates detected)
- Plate Extraction: 94.8% (459 out of 484 detected plates extracted)
- Character Segmentation: 98.3% (451 out of 459 extracted plates segmented)



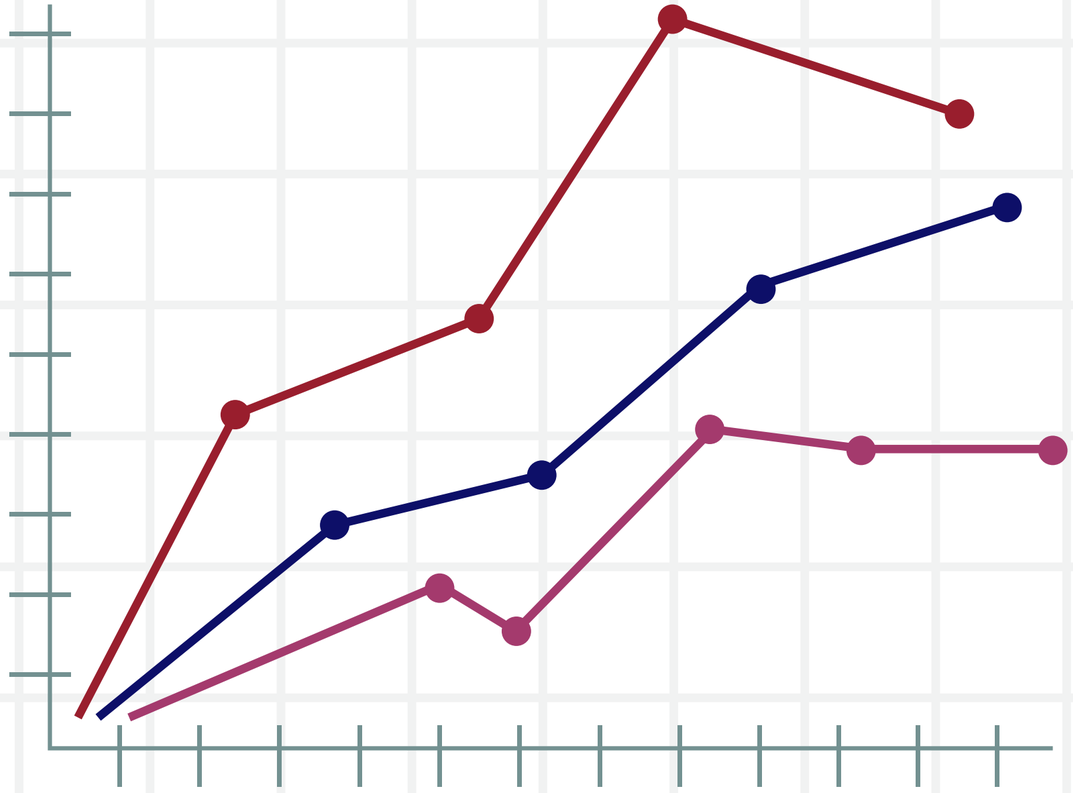
ACHIEVED ACCURACY

- Character Recognition: 97.6% (440 out of 451 segmented plates recognized)
- Word Recognition: 98.3%
- Letter Recognition: 98.4%
- Digit Recognition: 98%



OVERALL ACCURACY

- Detection Accuracy: 96.8%
- Extraction Accuracy: 94.8%
- Segmentation Accuracy: 98.3%
- Recognition Accuracy: 97.6%



ACCURACY COMPARISON WITH EXISTING METHODS

References	Plate language	Sample size	Accuracy (%)					Total processing time (milliseconds)
			Detection	Extraction	Segmentation	Recognition	Authentication and verification	
Proposed Method	Bangla	500	96.8	94.8	98.3	97.6	100	113
Hossain *et al.*, (2018)	Bangla	50	94	--	--	95.7	N/A	184
Rabbani *et al.* (2018)	Bangla	100	93.8	--	95.5	97	N/A	--
Shahed *et al.* (2017)	Bangla	30	95	--	--	85	N/A	750
Roy *et al.* (2016)	Bangla	180	93	--	98.1	88.8	N/A	--

LIMITATIONS

TILT ANGLE HANDLING

The system can correct tilts of up to 45 degrees; beyond that, it cannot process the image

IMAGE QUALITY

The system may fail when the input image is too blurry, features excessive noise in the background, has very low resolution, or if the number plate is damaged.

RESULT SUMMARY

EFFICIENCY

The proposed system operates efficiently, providing fast verification by directly searching the cloud database, resulting in a shorter processing time compared to alternative methods

COMPARISON WITH EXISTING METHODS

When compared to other existing methods, the proposed approach stands out due to its significantly higher sample size, superior accuracy, and unique ability to authenticate and verify number plates

TECHNOLOGIES

The research was conducted using MATLAB 2019a in an environment comprising a 64-bit Windows 10 Pro operating system, Intel Core i7 CPU, 1TB hard disk, 500 GB SSD, and 8 GB RAM. A Gigabyte RX 6900 XT GPU with 16 GB RAM was used for faster processing

APPLICATIONS

RESEARCH SUPPORT

This research creates a valuable dataset of Bangla templates, aiding researchers in automating Bangladeshi car number plate detection, recognition, and verification

REVENUE COLLECTION

Offers the Bangladesh Road Transport Authority (BRTA) the capability to automatically identify unregistered vehicles or those with expired tax tokens using their cloud database, facilitating the collection of registration fees and taxes

APPLICATIONS

ENHANCED SECURITY

Assists traffic authorities in identifying stolen or suspicious vehicles by simplifying the comparison of extracted data with BRTA's cloud database of reported number plate details

VERSATILE APPLICATIONS

The system's utility extends to various applications, including automatic car parking management, toll collection, and law enforcement by the Bangladesh police.

Thank You