AUTOMATIC LICENSE PLATE RECOGNITION (ALPR) FOR MALAYSIAN VEHICLES: ENHANCEMENT & EVALUATION
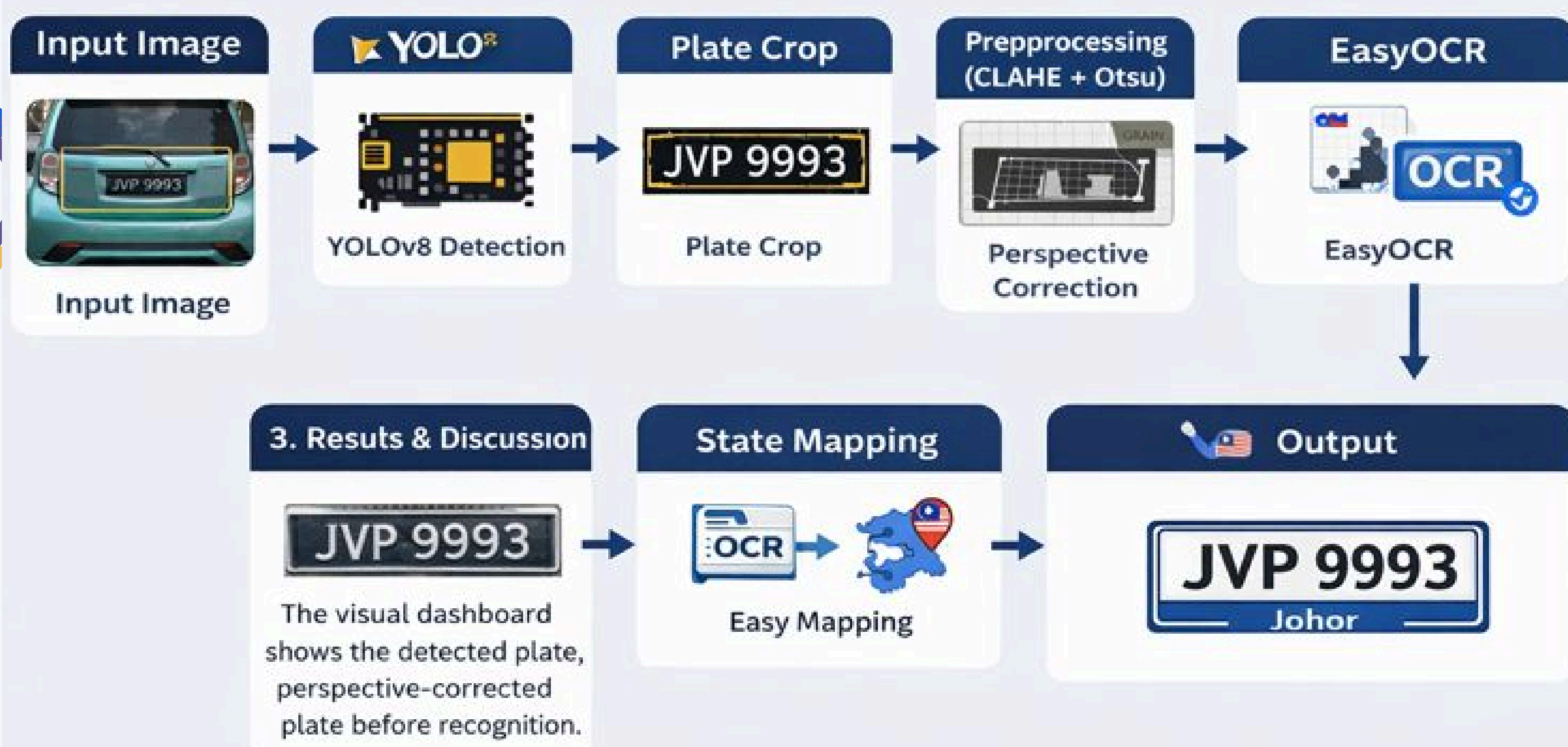
INTRODUCTION & PROBLEM STATEMENT

ALPR Overview

- Automatic License Plate Recognition (ALPR) is a computer vision system that automatically detects and reads vehicle license plates from images or video streams. It is widely used in parking management, toll collection, traffic enforcement, and security surveillance to enable real-time vehicle identification and monitoring.

Problem Statement

In Malaysian environments, plate recognition is challenged by low lighting, high-angle CCTV views, motion blur, and inconsistent plate fonts. These conditions often result in skewed, noisy, or poorly illuminated plates, significantly reducing recognition accuracy. This project focuses on improving ALPR performance under such real-world conditions.

System Pipeline

Input Image → YOLOv8 Detection → Plate Crop → Preprocessing (CLAHE + Otsu) Perspective Correction → EasyOCR

3. Results & Discussion → State Mapping (Easy Mapping) → Output JVP 9993 Johor

The visual dashboard shows the detected plate, perspective-corrected plate before recognition.

METHODOLOGY

– Baseline Approach
The baseline ALPR system uses YOLOv8 for license plate detection and EasyOCR for character recognition. This provides an end-to-end pipeline from raw input image to recognized plate text.
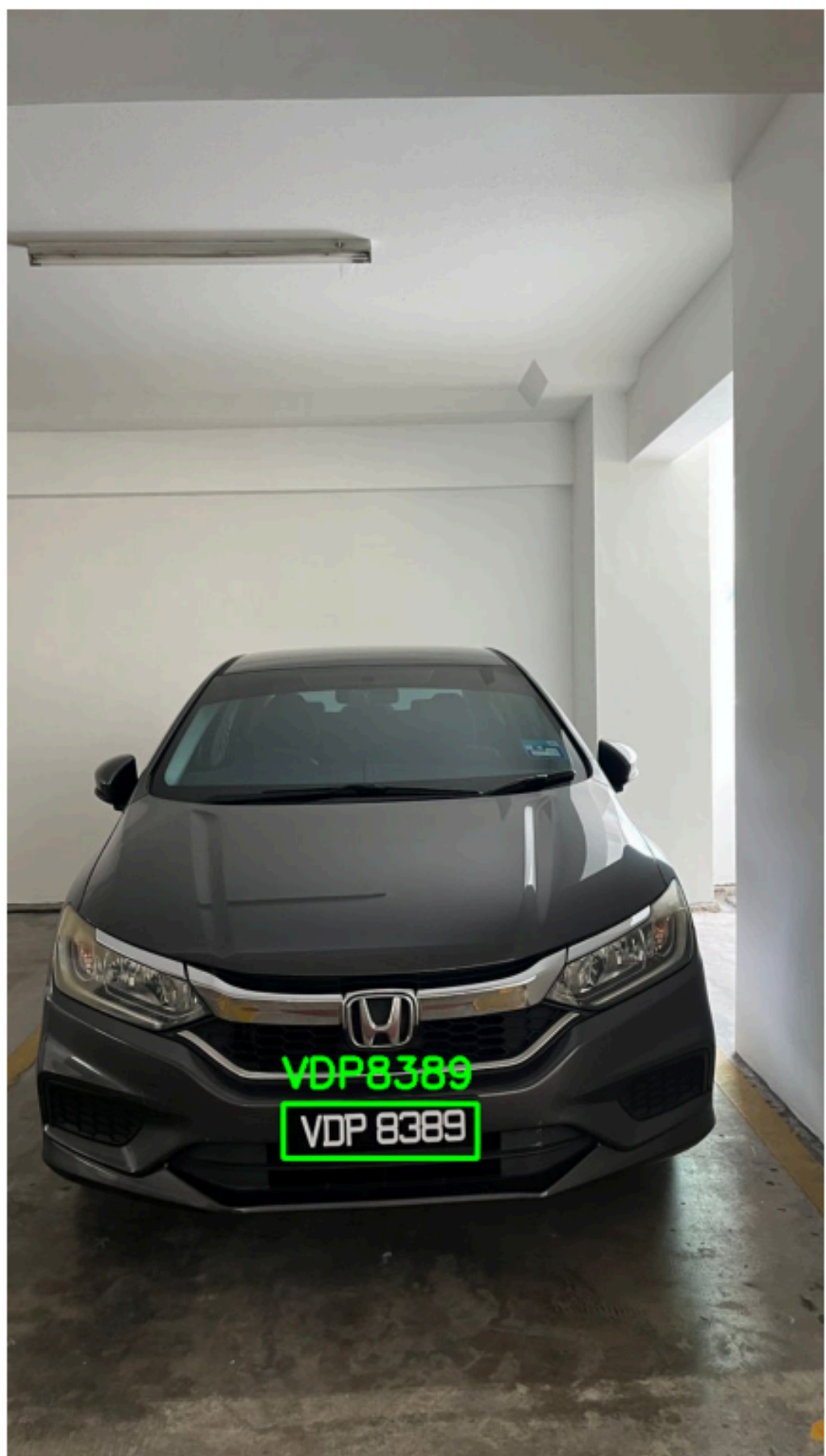
Proposed Innovations

- A super-resolution model can be added before OCR to improve clarity of low-resolution plates.
- Support multi-vehicle and multi-plate images
- Improve detection confidence filtering
- Add confidence score for OCR results
- Storing recognition results in a database would allow further analysis and reporting for intelligent transportation systems.

RESULTS & DISCUSSION

- YOLOv8 successfully detected vehicle license plates from image dataset
- Works under different lighting conditions
- OCR accuracy decreases for blurry plates

Malaysian ALPR System - Final Evaluated Output
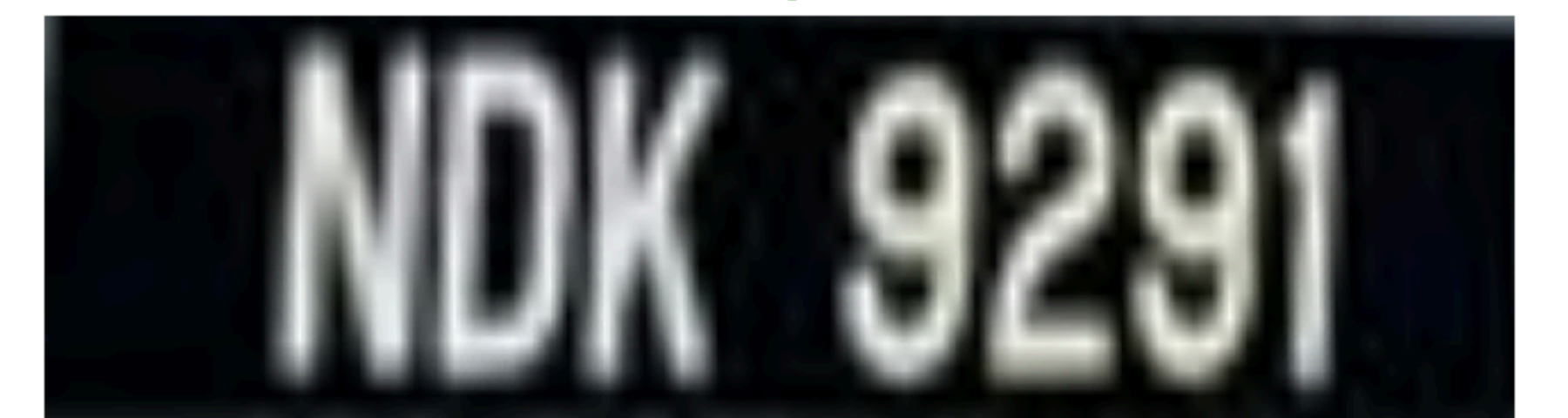

BASELINE vs INNOVATION ALPR Comparison

BASELINE: Original Crop NDK 9291

INNOVATION: Perspective Corrected NDK 9291

BASELINE: Grayscale NDK 9291

INNOVATION: CLAHE + OTSU NDK 9291

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BASELINE RESULTS:
  Plate: NDK9291
  State: Negeri Sembilan

INNOVATION RESULTS:
  Plate: NOK9291
  State: Negeri Sembilan
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SUMMARY STATISTICS

Total Images Processed: 100

------------------DETECTION PERFORMANCE------------------
BASELINE Detection Rate: 55/100 (55.0%)
  Avg Confidence: 0.544

INNOVATION Detection Rate: 84/100 (84.0%)
  Avg Confidence: 0.443

+ Detection Improvement: +29.0%

------------------PROCESSING SPEED------------------
BASELINE Avg Time: 0.065s (Total: 6.46s)
INNOVATION Avg Time: 0.080s (Total: 8.00s)
+ Speed Difference: +23.8% (SLOWER)

------------------OCR ACCURACY------------------
Average Accuracy: 43.8%
  Perfect Match (100%): 33 images (33.0%)
  Good (90-99%): 0 images (0.0%)
  Fair (70-89%): 9 images (9.0%)
  Poor (<70%): 58 images (58.0%)
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CONCLUSION & LIMITATION

- Conclusion
This project presents an enhanced ALPR pipeline incorporating geometric correction, adaptive preprocessing, and intelligent post-processing. The improvements significantly increase recognition reliability under challenging Malaysian road conditions.

LIMITATIONS

- EasyOCR accuracy is limited, especially in low light, motion blur, and small plates.
- Single-pass OCR only, with no fallback or voting system to correct errors
- Fixed warp output size forces all plates into one shape, creating distortion and reducing OCR accuracy.