Grenze International Journal of Engineering and Technology, June Issue

Review of Smart Document Verification System for Traffic Rule Violation

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***Abstract*— A prevalent issue with missing or expired vehicle paperwork has prompted the development of a digital service utilizing QR codes within the documentation. This innovation allows Rapid Transport Office (RTO) officers to swiftly access vehicle details and necessary documents via smartphone scans. Traffic cameras equipped with QR code capabilities also verify documentation, issuing fines or notifications when needed. Users benefit from renewal reminders, streamlining processes, and lowering fine risks. This service not only saves time and resources but also encourages compliance with documentation standards, effectively addressing the persistent challenges of missing or outdated paperwork in the realm of vehicle management.**

***Index Terms*— QR Code, RTO Officer, Smart Document Verification, Traffic Rule Violation.**

I. INTRODUCTION

To tackle the following challenging issues, we developed the Intelligent Driving License Reading System (IDLRS): (1) distinct fields and contents from various driver license types and versions; (2) varying capturing angles and illuminations from a mobile camera; and (3) quick processing for practical applications. We suggest immediately detecting multiple field contents in a single shot by utilizing and optimizing the recently released YOLOv3-608 detector, which can identify 11 fields from the new Taiwan driving license with 97.5% accuracy, in order to preserve high detection accuracy and adaptability. In large viewing angle tests, our method performs better than those based on OCR or text detection. In order to do more research, we conduct assessments in four major tilting view configurations (upper, lower, left, and right) and attain accuracy rates of 93.3%, 90.2%, 97.5%, 94.3%, respectively[3].

ANPR-based E-Challan Generation System with Desktop Application[2]. Authorities have discovered that putting in place an automated number plate recognition system for electronic challan manufacture has been a useful instrument for addressing these problems. This technology gives offenders a simplified way to manage their fines using E-challan, while also enabling the effective treatment of traffic rule breaches. This project's main objective is to develop an electronic challan system that reliably recognizes license plates from passing cars using technologies for license plate recognition. The registered owner's cellphone number, which is connected to the vehicle's registration number, will thereafter get an SMS with a challan. Cameras are used to take pictures of the cars that are in violation of the law. An Automatic Number Plate Recognition (ANPR) technology is then used to identify the license plate information and segment the characters. After that, the detected license plate is examined against the database.

Grenze ID: 01.GIJET.10.2.251

Regional Transport Office Registration System Based on Android[4]. The proposed ERTO (Electronic Regional Transport Office) Management System aims to simplify vehicle registration and insurance in India. It aims to provide a dependable, accurate, and time-saving alternative to the current system while minimizing misuse. The system will store all relevant vehicle and driver information in a centralized database managed by the RTO. This application has the following advantages: Corruption reduction: The system aims to significantly reduce corruption in the transportation department by digitizing the registration and insurance processes. It establishes a transparent and accountable system that reduces the possibility of malpractice. Safekeeping of license documents: Vehicle owners frequently forget to keep their license with them while driving.
Research on document authentication methods and cross-referencing using QR codes[7]. Research has shown that bogus papers typically propagate more quickly than news that is true or accurate. These days, internet documents and identities are standard practice. Businesses require reassurance that they won't be duped by these papers, and documents themselves need to be secure and pure. Document Verification System is essential to determine whether the document has been edited or tampered with. Verification of documents is the process of determining if a certain file is legitimate.
Pyzbar Real-Time License Plate Recognition using QR Code in Automobiles[8]. It has previously been considered to use QR codes to verify vehicles. Police were able to use a QR Code detection and identification system analysis to verify the legitimacy of vehicle paperwork. The authors suggested storing owner and vehicle information in QR codes. No detection was done, even though these works effectively illustrated the significance of QR codes in vehicle certification. The main goal of this research is to use the OpenCV Python-based PyZbar library to develop a safe system for identifying QR codes on QR code license plates.

II. Related Work

We divide related work into several key categories that have a direct impact on our research.
Ashwini Ghodeswar, Harshad Nikam, and Harshal Patil: A completely CNN plus a method for post-processing neural network outputs make up the YOLO v5 algorithm. Neural network designs called CNNs are made especially to handle data topologies that resemble grids. One characteristic that sets CNNs apart and is crucial for object recognition is parameter sharing. Each member of the kernel is utilized at every position of the input in CNN design, in contrast to feedforward neural networks, which use each weight parameter only once. This implies that one set of parameters is learned for each location rather than a different set of parameters for each site. This feature is essential for capturing the entire scene on the road[1].
Ming-Ching Chang, Chun-Ming Tsai, Jun-Wei Hsieh, and Yu-Chen Lin: Tables are an essential part of documents in order to provide structural information. Recent studies have concentrated on the analysis and identification of tables. Three main areas comprise the survey of prior works: table content understanding, table layout identification, and table detection. Finding and localizing table borders in a document picture is the focus of table detection. Internal table structures like rows, columns, and cell borders are sought for by table recognition[2].
Rushika Chaudhari, Pranav Chaudhari, Damini Dubey, and Vaishnavi Shinde: Cameras are used to take pictures of the cars that are in violation of the law. An Automatic Number Plate Recognition (ANPR) technology is then used to identify the license plate information and segment the characters. After that, the detected license plate is examined against the database. The suggested remedy described in this work makes use of an advanced real-time machine intelligence system to guarantee accurate number plate recognition of the vehicle and, by determining the particular traffic infraction committed, creates an electronic challenge in the registered owner's name. Thus, this automated procedure guarantees more efficient traffic regulation enforcement, greatly lessens the workload of manual labor for authorities, and streamlines challan management and monitoring[3].
Anandan Rajendran, Srikanth Bhyrapuneni: The suggested approach uses a multi-layer network ANFIS model for word detection from pictures. When the text extraction accuracy of the suggested model is compared with that of standard methods, the findings indicate that the proposed model performs better and requires less time[6].
Utkarsh Pathaka, Venu Sonavaneb, Mitali Gadiyac, and Suyash Musaled: The segmentation used in OCROpus is heavily reliant on image resolution-derived thresholds. We also try to achieve the highest possible accuracy for verification using machine learning models during this process. The benefits of using machine learning for verification include improved forgery detection, scalability, and fraud protection. K-means clustering is used in content verification to group symbols and characters in a binary document into different classes. The classification of noisy variants of the same character class[7].
Judith Nkechinyere Njoku, Nkoro Ebuka Chinaechetam, Jae-Min Lee, and Dong-Seong Kim: This paper proposes a system for detecting QR codes on license plates using Pyzbar, a Python library specifically designed for detection tasks. The law enforcement agency generates the user's QRcode, which contains the vehicle owner's information

and is securely stored in the database or cloud service. When the license plate reader system scans the Q-plate, it automatically detects the embedded information and prints it while updating the database, which is accessible in real time via the network. This proposed system prevents unauthorized access to the vehicle owner's information[8].

Dr. S. Vijayarani, A. Sakila: In machine learning, K-Nearest Neighbors (KNN) is a well-liked and straightforward classification technique. It falls under the category of supervised learning and finds use in data mining, intrusion detection, and pattern recognition. KNN does not assume anything about the distribution of the data because it is non-parametric. It performed based on two factors: a suitable parameter K value and a suitable similarity function. The KNN requires less execution time and is simple to interpret. The KNN is a well-known method for classifying characters from document images[12].

Surya Teja Kothagattu1, Kunam Siri Chandana, R. Srinivas, B. Prasanthi: Tesseract uses a two-pass approach to character recognition. Known as "adaptive recognition," the second pass leverages the letter shapes identified with high confidence in the first pass to identify more letters in the second phase. Rare typefaces or poor-quality scans with deformed fonts may benefit from this[13].

V.P.Mahadevan Pillai, Sajan Ambadiyil, Haritha Sree G S: Different algorithms are available to find feature points on a face. However, there is a 16-point maximum limit on the amount of feature points that may be found. Maximum points with significant associations need to be discovered with high precision in order to extract relevant information from the periocular area. 32 of the 66 feature points on the face, which are located in the periocular area, may be found and extracted as coordinate pairs using this algorithm[17].

III. Algorithmic Survey

Here is a list of some popular algorithms and methods used in the context of Optical Character Recognition for text extraction from unstructured documents (such as images), along with their features and approximate accuracies. Please keep in mind that accuracy can vary depending on factors such as dataset, preprocessing, and implementation:

1. Tesseract OCR

- *Features:* Open-source OCR engine, supports various languages, and can be trained for specific fonts or patterns.
- *Accuracy:* Around 90-99% depending on the quality of the image and text complexity.

2. Google Cloud Vision API

- *Features:* Offers OCR capabilities along with object detection, handwriting recognition, and text extraction.
- *Accuracy*: Generally high, varying from 90% to 99%.

3. *Amazon Textract:*

- *Features*: Extracts text, tables, and forms from documents, supports various formats.
- *Accuracy*: Similar to Google Vision API, with accuracy ranging from 90% to 99%.

4. Microsoft Azure OCR

- *Features*: Part of Azure Cognitive Services, provides OCR functionality with good language support.
- *Accuracy*: Comparable to other major OCR tools, achieving 90-99% accuracy.

5. Pytesseract (Python wrapper for Tesseract)

- *Features*: Provides Tesseract OCR integration in Python applications.
- *Accuracy*: Performance depends on Tesseract's underlying version and settings, similar to Tesseract.

6. Deep Learning-based models (for example, CNN + RNN)

- *Features*: Convolutional neural networks are used for feature extraction, while recurrent neural networks are used for sequence modeling.
- *Accuracy*: Cutting-edge performance, achieving 95-99% accuracy on standard datasets such as MNIST, but training may necessitate significant computational resources and labeled data.

7. Faster R-CNN

- *Features*: Originally designed for object detection, but can be adapted for text detection in images.
- *Accuracy*: Depending on the implementation and fine-tuning, accuracy can range from 80% to 95%.

8. EAST (Efficient and Accurate Scene Text Detector)

- *Features*: Designed specifically for text detection in natural scenes.
- *Accuracy*: High accuracy, often achieving 90% and above on benchmarks like ICDAR.

9. YOLO

- *Features*: Primarily used for object detection, but variants can be adapted for text detection tasks.
- *Accuracy*: Varies based on implementation and dataset, typically achieving above 80%.

10. Convolutional Recurrent Neural Network (CRNN)

- *Features*: Integrates CNN for the extraction of features and RNN for a series modeling, making it particularly well-suited for sequence-based tasks such as text recognition.
- *Accuracy*: Meets or exceeds 90% accuracy on standard benchmarks.

11. OpenCV's EAST Text Detector

- *Features*: Implements Efficient and Accurate Scene Text (EAST) detection method in OpenCV.
- *Accuracy*: Achieves good accuracy, often above 90%.

12. SIFT (Scale-Invariant Feature Transform) and SURF (Speeded-Up Robust Features)

SIFT (Scale-Invariant Feature Transform) and SURF

- *Features*: Feature extraction and matching algorithms used in traditional computer vision. These steps can be used as pre-processing.
- *Accuracy*: While not as high as deep learning methods, it is still effective in certain scenarios.

13. Fine-tuned Pretrained Language Models (e.g., BERT, GPT)

- *Features*: Language models fine-tuned on OCR tasks for better text extraction.
- *Accuracy*: Depending on the domain and fine-tuning, can achieve high accuracy.

14. CRF (Conditional Random Fields)

- *Features*: Often used in sequence labeling tasks after text detection for improving recognition accuracy.
- *Accuracy*: Helps refine results from text detection methods, improving overall accuracy.

15. LSTM

- *Features*: A specific type of RNN, suitable for sequence-to-sequence tasks like text recognition.
- *Accuracy:* High, especially when combined with CNN for feature extraction.

Accuracy figures are approximations that can vary greatly depending on the dataset, image quality, preprocessing, and implementation details. Choosing the best algorithm frequently necessitates experimentation and fine-tuning depending on what is required of the task at hand.

IV. Conclusion

The idea has reduced the problems associated with violating traffic laws on the road. This interface helps prevent corruption and enforce traffic laws. A vehicle verification system with a unique QR code is used to solve real-time issues involving the security of important documents such as driver's licenses, PUCs, insurance, and RC books. This system improves transparency, authenticity, and reduces the corruption of fake documents by digitally verifying vehicle documents. It also reduces the RTO's administrative burden by using fewer papers. Vehicle inspectors are not permitted to impose additional penalties or bribes because this application covers every type of fine and the amount that must be paid. When the documents expire, the owner will be informed at the appropriate time. So there will be less paperwork, accessing the online application will take a smaller amount of time and effort.

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