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Smart Eye – The Vehicle Surveillance System

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Abstract: *Most vehicle checkpoints have a security officer who checks the entry information by inspecting the identification document as part of the entry process for visitors, staff, and others entering the region. Given that this process is manual and involves validation and registration, there is a high likelihood that human error will be present. Manually entering admission and exit data and recording it on a register can be a difficult and time-consuming operation for security personnel at the checkpoint. It is challenging to disseminate the information entered because it is on paper. Thus we need an automatic system, which will reduce manual entry process and minimize the security personal effort. When a vehicle reaches the vicinity of the check point, the security personnel can scan the vehicle number plate and the drivers face and verify their identity from the database and will also store the information. Through this system, security and authorized personnel will be able to keep track of vehicle movement along with its drivers information. The suggested approach will shorten check-in and check-out times while also suggesting additional advantages for managing parking and traffic.*

Keywords: Entry/Exit Process, Face Recognition & Verification,Number Plate Recognition & Verification

I. INTRODUCTION

A Vehicle Surveillance System (VSS) is a system that monitors and tracks the activities of vehicles, usually for security purposes. The VSS can be implemented using two important technologies - Number Plate Detection (NPD) and Face Detection (FD). Number Plate Detection involves the use of image processing algorithms to detect and recognize the license plate of a vehicle. This information can then be used to track the movement of the vehicle, match it with a database of registered vehicles, and ensure that it is not involved in any illegal activities. Face Detection, on the other hand, is used to identify individuals in a crowd. In the context of VSS, FD can be used to identify the driver of a vehicle. This information can be used to cross-check the identity of the driver with a database of individuals who are not allowed to drive. The combination of NPD and FD in a VSS can provide an effective means of monitoring and tracking vehicles, ensuring their compliance with traffic laws, and ensuring public safety. The system can be installed at key locations such as intersections, toll gates, and border crossings, to monitor and track vehicles in real-time.

II. LITERATURE SURVEY

"Face Detection in Extreme Conditions: A Machine-learning Approach" Sameer Aqib Hashmi Department of Electrical and Computer Engineering North South University, Bashundhara Dhaka, Bangladesh. Numerous face detection methods have been proposed over the course of several years. Modern face detectors that have a sophisticated understanding of structures are almost perfect, outperforming humans in this area. In a variety of computer vision applications, including picture class and face popularity utilise cascaded CNNs for face detection, convolutional neural networks (CNN) made tremendous progress. They suggested a multi-task cascaded CNN-based architecture for face identification in this publication. The MTCNN approaches consistently outperform alternative frameworks, according to experimental data.

Automatic Number Plate Recognition Abhishek Kashyap, B. Suresh, Anukul Patil, Saksham Sharma, Ankit Jaiswal. Electronics and Communication Engineering Department, Jaypee Institute of Information Technology, Noida-201304, India. Number Plate Recognition system is used for many purposes by Tollway authorities, RTO Authorities which consider the number plate of vehicle as core component. Binary Image Processing is method which is used to mine license plate regions from background images which extract the exact number. They also used the Color processing as

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fundamental step for plate recognition as in most of the countries certain norms are fixed for the plate color.

"Face Detection and Recognition" Akanksha, Jashanpreet Kaur, Harjeet Singh , BHSBIET,Lehragaga. One form of biometric technology known as "facial detection" refers to the automatic recognition of faces by computers systems by looking at faces. Face detection can also be broken down into real-time face detection and face detection in photos. In this study, they use picture invariants to try and find faces in still photos. The benefit of employing geometrical features as the foundation for face recognition is that it is feasible to recognise faces even in noisy and extremely low resolution photos. A robust face recognition model based on the mapping of behavioural features with physiological biometric information is contributed by the facial expression recognition system.

"Automatic Number Plate Recognition System (ANPR): A Survey" Chirag Patel Smt. Chandaben Mohanbhai Patel Institute of Computer Applications (CMPICA) Charotar University of Science and Technology(CHARUSAT) , Atul Patel, PhD. Smt. Chandaben Mohanbhai Patel Institute of Computer Applications (CMPICA) Charotar University of Science and Technology(CHARUSAT) . Dipti Shah, PhD. G. H. Patel P.G. Department of Computer Science S. P. University. In this paper they have worked on improving the process of detection of number plates. This paper involves the use of Edge detection, Hough Transform , Blob detection which resolve the issues related to complex images , detecting points or regions that differ in brightness or color as compared to surroundings.

Overall, the literature suggests that the Face Detection and Number Plate Detection has the potential to bring significant improvements to the Vehicle Surveillance System. The technology has the potential to improve efficiency, transparency, security and making it a promising solution for the field. However, further research is needed to explore the implementation challenges and to develop standards before applying it.

III. PROPOSED SYSTEM

The proposed system for Vehicle Surveillance aims to improve the efficiency and transparency of the Surveillance and the Management process of Vehicles. The system leverages the features such as immutability, transparency, and security, to create a secure and tamper-proof record of all activities of the Vehicles. By eliminating the Paper based Manual process, the system streamlines the surveillance process. Using the system the Operator will be able verify the Vehicle and the Driver before allowing them access. Also the system will note the movement of the Vehicles and their respective Drivers as permanent immutable records. The proposed system offers a more efficient and secure alternative to the Traditional Surveillance System.

IV. SYSTEM ARCHITECTURE

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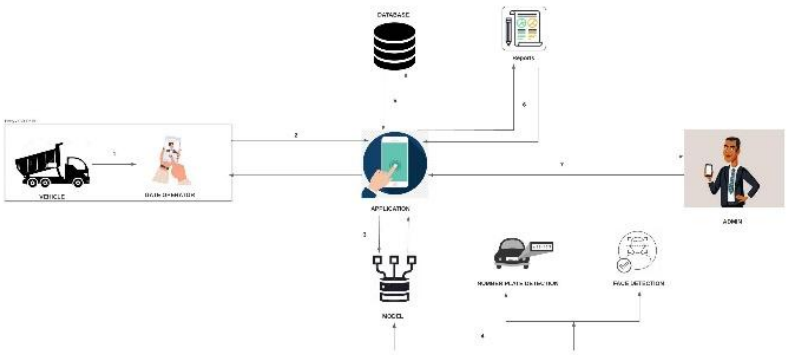

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V. GOALS AND OBJECTIVES

5.1 Goal

The goal is to create a system which can help to monitor the activities of the vehicles at a given Plant/Site. A system using which the admin(owner) can manage activities at a plant without actually being present there.

5.2 Objectives

1. To Make Process Transparent: The activities recorded by the app are visible in reports which creates transparency to view activities at any time.
2. To Make Process Immutable: All records are kept permanently which cannot be altered unless the admin needs to make changes to the activities/reports if necessary.
3. To Make Process User-Friendly: The system is designed in such a way that no specialization is required for using it.

VI. LIST OF FUNCTIONALITIES

6.1 Scanning

1. It includes scanning the number plate of the vehicle and the drivers face.
2. Scanning is performed using the camera of the device.
3. Once scanning is successful the vehicle and driver's information is sent for verification.

6.2 Verification

1. Verification includes verifying the vehicle and the driver.
2. Vehicle is verified by matching the number plate with company database.
3. Using the same procedure the drivers face is verified.
4. Once verification is successful the vehicle will be allowed to enter/exit.
5. When the operator allows access to the vehicle the information is saved in database.

6.3 Reports

1. Reports are generated once verification is completed and access is allowed.
2. Reports include Vehicle's Number, Driver's Name, Current Status(In/Out) , Date and the time of entry/exit.
3. A Search feature is also available in reports.

6.4 Search Feature

1. Search feature allows to search by the number, name , date and time.
2. Any specific vehicle can be search for In/Out status, last activity and the driver.

6.5 Manage Vehicle Feature

1. Manage Vehicle feature allows the admin to view entire list of vehicles he has under his ownership.
2. Also it allows to add new vehicles and delete existing vehicles to the list.
3. This feature is very useful when new vehicles are added for work and existing ones are removed.

VII. METHODOLOGY

When vehicle arrives at the gate, the operator will capture the photo of the driver to verify the driver of the vehicle. Then operator will capture the photo of the number plate of vehicle to verify the vehicle whether it belongs to the plant or not. Then user will set the status of vehicle in or out and mark the entry of vehicle. Further admin is the one who can analyses the reports of vehicle And also he can manage the vehicles from his plant. Below, the roles of the Operator and Admin are explained.

1. Vehicle arrives at the gate to enter/exit the plant.
2. Operator at the plant scans the number plate and the face of driver.
3. Once the scanning is completed, the vehicle and the driver get verified through the system.

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4. For successful verification, it gets stored as record in database further allowing the vehicle to enter/leave.
5. These records are saved in reports.
6. When the admin wants to view the activities of the vehicles, they are displayed in the reports section.
7. Reports include the vehicle number plate, drivers name, date and the time and the current status of vehicle.

Admin:

1. Determine the current status of the vehicle.
2. Observe the reports generate by the system for the Vehicles and their drivers.
3. Remotely manage the activities at Plant/Site using the System.

Operator:

1. Capture the Images of the Vehicle Number Plate and the Driver.
2. Once the verification is successful then allow them access to enter/exit.

There are multiple methodologies implemented in this process to achieve the expected results like face detection, face recognition, OCR, ANPR, handling database, which are explained further.

1. Building TF Lite Model For Face Recognition

For the verifying the face of the driver firstly we need a face dataset to train a model on it. For that We are using the Keras Efficient Net model which is CNN(convolutional neural network) mainly used for image classification, object detection, face recognition etc. It has multiple variants from effifcient B0 to efficient B7. Firstly we need to pick the right layers that is intermediate layers from cnn as they work good for feature extraction. The main idea behind this is to use the output from the previous layer as an input to next layer. The aim is to select the “Bottleneck Layers” which is used to reduce the cost of operation while maintaining the accuracy. And with some processing on images before and then the model is trained with right no of epochs and batch size. With the help of lr_reducer the most accurate model is picked and further it is converted into a TF Lite model.

2. ANPR (Automatic Number Plate Detection)

When the user will click the photo of the vehicle number plate, we want the number to be extracted from the number plate and then it will be verified with the database. For that OCR(Optical Character Recignition) is used on the detected number plate. OCR is used for text recognition. When the user takes the clearer photo and then the text is extracted to the field using OCR. Next thing is to process the extracted text.As we are extracting the number of vehicle, it need to be in Correct format to validate with the database. As the number must be of 10 digits to be a valid number. Another problem with the OCR is it will extract the number from the number plate with the extra undesired characters like spaces, commas, dots and etc. We need to process the text like formatting the text by converting it into a valid form before validating with the database.

3. Database Handling

All the entries that are mark by user will be stored in the database.The database used to save the data related to the vehicle is Firebase Realtime Database. This contains the field like name of the driver, vehicle number, time, date and status. This report can be usefull further to analyze the behavior of vehicles.As this app provides the feature to searh the data from the report by fields mentioned above. But For that the vehicle number must be present into the vehicle database to be allowed into the plant and mark into record. This Feature can be used by only admin, User can’t access the features other than the scanning. Further More One more feature is given to admin like handing the vehicle. Admin can add or delete the vehicle to the database and also checkout the vehicles from the database.

VIII. RESULTS

This system provides a way for accurately storing data about the activities of vehicles at building sites, plants, etc. using image processing, face and number plate detection, machine learning, and deep learning technology. It shows whether

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the Vehicle is Inside/Outside the construction plant using the face detection and number plate detection technology. It also stores the accurate results of the vehicle and its driver which is immutable i.e. it cannot be altered by external factors. The results obtained using this technology (reports of the vehicles) can be useful if auditing needs to be performed.

IX. CONCLUSION

By offering a safe and effective solution for the surveillance of vehicles, the Vehicle Management System has the potential to transform the Surveillance Field. The use of Automatic Number Plate Recognition and Face Recognition enhances transparency and accountability by which the System can work Error free. The system's functioning will be further improved through the addition of a user-friendly interface, and stakeholder cooperation. The system will stay current and relevant with the changing needs of Surveillance Requirements and Record Management.

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