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SMART BARRIER GATE TO AUTOMATE A SECURITY GUARD HOUSE USING DEEP LEARNING TECHNIQUES

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Abstract

Installing a security guard house at the apartment's door is one of the options to safeguard the building and its staff members against hostile attacks. The people who live or work at the facility are protected by a personal security guard and security tools in a security guard's house. This study aims to investigate the effectiveness of this proposed system, and the traditional system applies to the real world. A security guard house is the most significant element for every apartment. The purpose of this research to implement the technology in a security guard house is to reduce the cost of employing a security guard. In the era of IR 4.0, the purpose system plays a huge role in automating the task where individual security cannot complete all verification on a single authorized vehicle within a short period. The proposed approach can reduce the workload of a single security guard through the camera records the vehicle license plate inserted into a database. Deep learning is a technology frequently used to recognize many distinctive item shapes. This research proposal offers a method of using deep learning for security guard authentication since it developed a unified strategy for multiple object detection and classification to pinpoint a distinctive quality of an object inside the vehicle. It acts as a virtual gate by allowing visitors to sign up who want to enter the neighbourhoods using multiple object recognition on the car and the driver's face. According to the trial, there is a 75% accuracy rate for detecting faces and objects which is sufficient for this study.

Keywords: Automated system, Deep learning, Industrial growth, Product innovation, Security guard, Smart barrier gate.

1. Introduction

Business owners hope that malicious attacks on their assets and personnel are prevented. One way to prevent harmful attacks on the building and its occupants is to place a security guard house at the apartment's entrance. To guarantee security is provided to those residing at or working at the site, a security guard house comprises a personal security guard and security tools [1]. Usually, a guard house is located at the entry and exit entrances the serves as a checkpoint to monitor and maintain the person who tried to enter or leave the place. The security guard house can instantly improve overall security since it has acted as an access control checkpoint [1].

In these decades, numerous parts of individuals' day-by-day lives have given more consideration to security. Security has become fundamental to business security concerns' bleeding edge [2]. In addition, open well-being has been a tricky issue; for example, brutality, fear, and robbery have made organizations in each area twofold check to guarantee that security is adequate to ensure individuals and resources [3].

The studies aim to investigate the effectiveness of this proposed system, and the traditional system applies to the real world. A security guard house is the most significant element for every apartment, either an apartment or a house [4]. The understanding is involved in the security guard verifying the motorist who wishes to drive their car to the apartment complex.

Security systems take place in schools and industry areas. The security guard house involves multiple physical security control. Howie has mentioned that many organizations or living sectors continue to be highly targeted for acts of violence, terror, and theft [5]. Recently, the security guard house has been pushed as the front line of the defence of business security concerns. The purpose of using a security guard house in each apartment is to avoid the act of violence, terror, and theft that will occur disorderly to people working or living in the apartment facility [6].

The proposed system includes automatic number plate recognition, face recognition, and object detection to identify and verify the unique character of the object's shape. The proposed system's implementation acts as a "virtual gate" to determine the authorized vehicle to access the apartment.

The best utilization of the GPU is to train and predict each object of the vehicles. It has been observed that the proposed model achieved high accuracy when applied with a threshold to avoid third-party object overlaps during the prediction session [7]. Given a general panorama of past-to-present literature, Bootkoski has concluded that YOLOv4 is a suitable algorithm for identifying unique shape objects that significantly recognize alphanumeric characters [8].

Implementing this technology in security guard houses reduces the cost of employing a security guard. In the era of IR 4.0, the purpose system plays a huge role in automating the task where individual security cannot complete all verification on a single authorized vehicle within a short period [9]. The proposed approach can reduce the workload of a single security guard through a camera record of the vehicle license plate inserted into the database.

2. Methodology

The general research structure and strategies involved in this investigation allow us to accurately state the research issue and show the reader that the methodology and sources are suitable for the theme, as shown in Fig. 1.

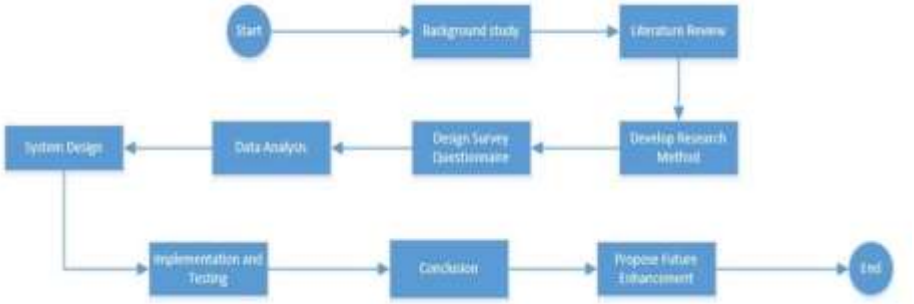

Fig. 1. Methodology diagram.

The data collection will be conducted through an online survey by utilizing google forms to understand the input from the respondent concerning the proposed highlight applied to the security guard. Many respondents are required and rely upon the reactions, and a hardcopy survey form may also be used to ensure a sufficient sample size collected for analysis purposes.

A questionnaire is a method to conduct quantitative research to collect quantitative data. This method allows the researchers to manage a prominent example of data collected through surveys. A survey question will be sent to users either through email, URL, or on paper, and the client will give input on the questionnaire. In any case, a set of questions should be planned and surrounded. Questionnaires are economical and straightforward to circulate, and reactions from a comprehensive developed survey can be determined and broken down rapidly.

Data analysis in qualitative research is a process of deliberately searching for observation notes or other non-textual material that the researcher amasses to expand the understanding of the phenomenon.

Here is an example of the entry flow process for residents and visitors, which is differentiated and explained in Figs. 2 and 3.

2.1. Rich picture diagram

A rich Picture is an approach to investigating, perceiving, characterizing, and expressing it in a graph to make an extra mental model. Rich paintings will open conversations and help to comprehensively share and comprehend the circumstance, as shown in Fig. 4.

2.2. User interface

In this section, the user interface has been developed to give the user a good experience - the application's main page, as shown in Figs. 5 to 8.

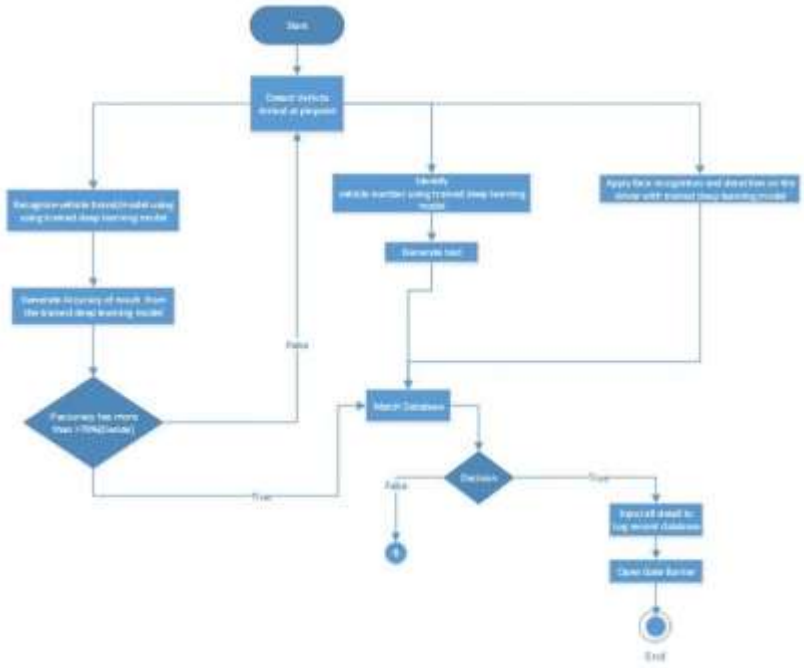

Fig. 2. Meth Flowchart for the registered resident's process.

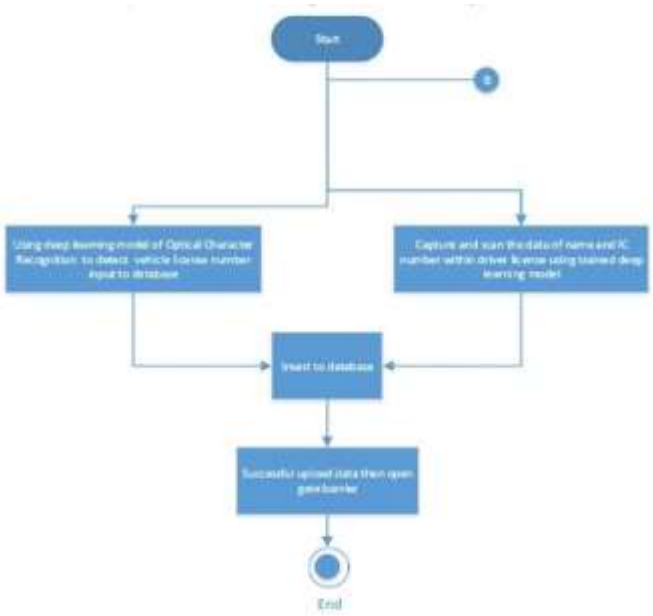

Fig. 3. Flowchart for guests who attempt to enter the facility.

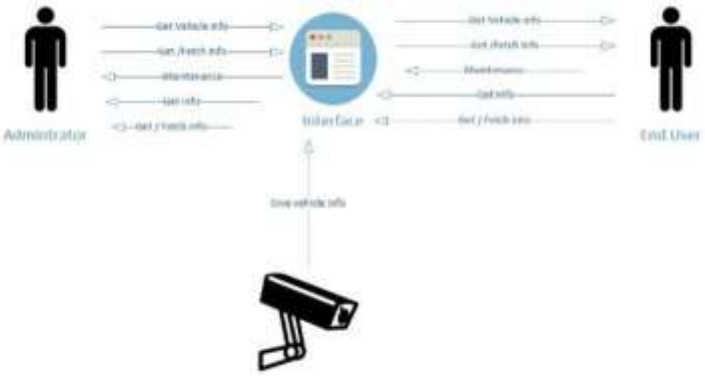

Fig. 4. Rich picture diagram.

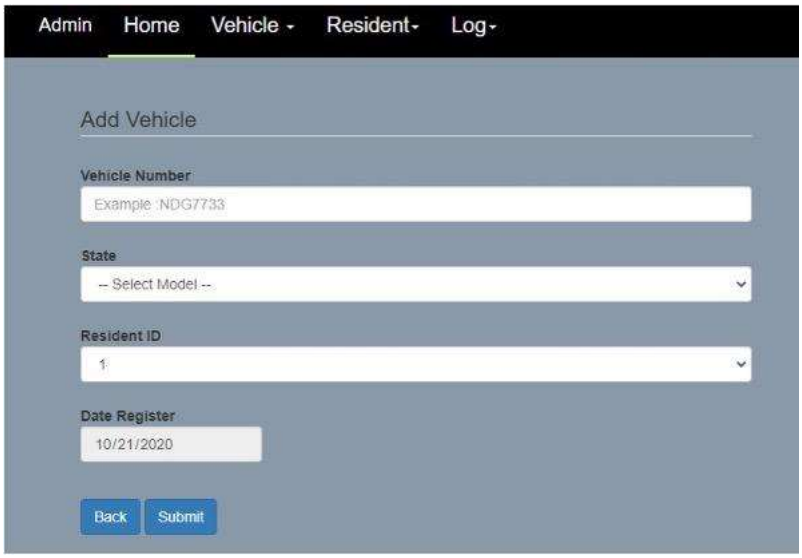

Fig. 5. Add vehicle.

Fig. 6. View vehicle.

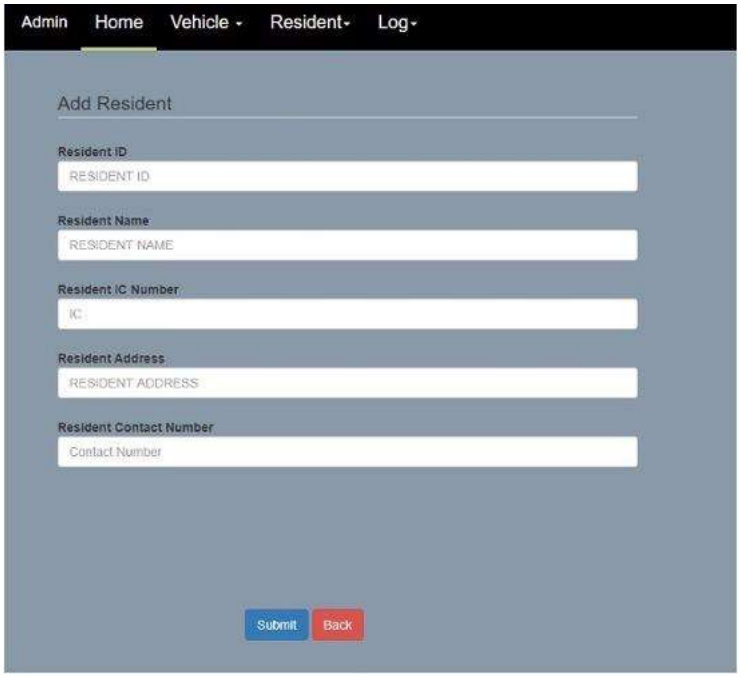

Fig. 7. Add resident.

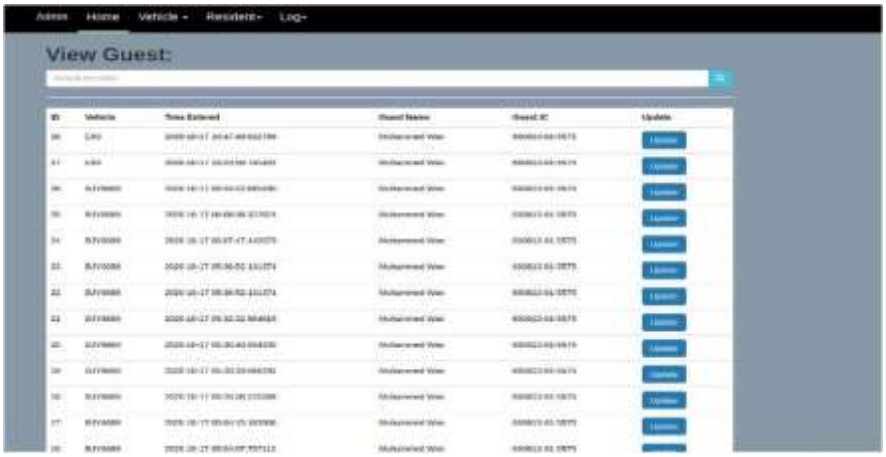

Fig. 8. View guest log.

2.3. System implementation

The plan of the proposed system is like the existing system. Before executing the coding stage, the researcher needs to discover what and how the tools will be used and also consider which programming language will be is appropriate for the proposed system.

The proposed project or research must utilize a few development tools to guarantee that the system can run appropriately without mistakes. Setup is

additionally one of the significant variables in building up an environment, importing the module and libraries.

2.4. YOLOv4

YOLOv4 is one of the deep learning algorithms that utilizes a neural network to recognize and ready to show the item's name with a bounding box within the input of the image [10]. ROI is called a Region of Interest or bounding box, an operation commonly used in object detection. For instance, to perform multiple detections within an image with different items and a person on foot in a video and Picture, it can capture each object with ROI to identify the thing in the image or video.

ROI is used to create multiple classes of objects, such as image ROI circles or image ROI rectangles. The reason for using this algorithm is to identify the percentage accuracy of the thing [11]. If the accuracy of the object is more than the expected percentage, then the proposed system will continue to execute the following algorithm [12]. YOLO predicts an object accuracy for each bounding box using logistic regression. YOLO changes the way calculating the cost function. If the bounding box prior (anchor) overlaps a ground truth object more than others, the corresponding object's score should be 1. They incur no cost for other priors with overlap more significant than a predefined threshold (default 0.25).

2.5. Nanonets

Nanonets is an API service provider that allows developers to create their custom OCR model for their projects [13, 14]. It offers to transform the unstructured, human-readable text into structured and validated data using OCR + Deep Learning to extract relevant information. Digitize everything from documents and PDFs to number plates and utility meters. Extract relevant info and required fields. This API recognizes the guest's IC text and the resident's vehicle number plate.

2.6. LabelIMG

LabelImg is a graphical picture annotation tool. It is written with several python modules or libraries. Annotations are stored either as an XML file in PASCAL VOC format, the arrangement utilized by ImageNet. Additionally, it likewise supports the YOLO format.

3. Result and Discussion

This research focuses on the testing of the proposed system by capturing the image at a few volunteers' house's car parking as a real-time example of the security guard house. Additionally, the testing is done to advance the exam and improve one's knowledge of how long the security gatekeeper must wait to approve each car that tries to enter the apartment facility. For illustration purposes, here are the pictures we obtained in the testing process, as shown in Figs. 9-11 for each test case.

Fig. 9. Test case 01.

Fig. 10. Test case 02.

Fig. 11. Test case 03.

Performance testing is conducted by running the system and noting the time taken for the proposed method to recognize the object from the vehicle number plate, vehicle brand model, and face of the driver. The purpose of executing this testing was that the exhibition is reasonable for this proposed system to guarantee the system meets the client's necessity.

The explanation behind YOLO utilizing GPU is that the time required for the proposed system to recognize the vehicle-attached object is just 9.32 to 8.41 seconds. On the other hand, the proposed system utilizing CPU has multiple times longer than GPU.

With this, the current system has accomplished the client prerequisite because the current system is ready to record every vehicle's plate number that entered the apartment. Yet, the traditional method of the security guard cannot be unfit to register the vehicle's access plate number within a short period. The conventional process of security guard monitoring may take longer than the current system since they must distinguish each s vehicle number and several other elements. The current system is ready to record every vehicle's plate number that entered the facility of the apartment. The current system's cycle time requires less than 15 seconds to distinguish and recognize the vehicle authorized to enter the apartment facility.

4. Conclusions

This study uses deep learning techniques to automate a security guard house with a smart barrier gate. The system is successfully developed with a speed of 9.32 seconds or less using YOLOv4, one of the deep learning algorithms, and Nanonets, which acts as an API service provider to enable developers to design their own bespoke OCR model. This accomplishment operates better than the current barrier gate, which requires more time around 15 seconds to identify a vehicle.

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