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A SMART ACCESS CONTROL FOR RESTRICTED AREA USING VEHICLE NUMBER PLATE RECOGNIZATION

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ABSTRACT

Recognizing vehicle number plates is a difficult but much needed system. This is very useful for automating toll booths, automated signal breakers identification and finding out traffic rule breakers for accessing restricted area. Here we propose a Raspberry Pi based vehicle number plate recognition system that automatically recognizes vehicle number plates using image processing. The system uses a camera along with LCD display circuit interfaced to a Raspberry pi. The system constantly processes incoming camera footage to detect any trace of number plates. On sensing a number plate in front of the camera, it processes the camera input, extracts the number plate part from the image. Processes the extracted image using OCR and extracts the number plate number from it and access the gate. The system then displays the extracted number on an LCD display. Thus we put forward a fully functional vehicle number plate recognition system using Raspberry Pi.

1. INTRODUCTION

Vehicle's plate number is a unique identity by which individual vehicle can be identified. Vehicle plate recognition system helps to capture a vehicle plate number, extract the numbers on the plate and check the details of the car owner. As the number of car owners in a country increases, identifying and charging unlawful vehicles on the road has been a tedious work for law enforcement agents. In this paper, we present an automatic vehicle plate recognition system using Raspberry pi. A Camera was incorporated to help in capturing the plate number images and it is interfaced to a Raspberry pi processor for authentication. Using the Open Computer Vision (Open CV) and Optical Character Recognition (OCR), the system can extract numbers from the captured plate image and completely automate the license plate recognition. The experimental results from several testing in different locations and conditions show that the system performed better than most of the baseline studies considered. Automatic license plate recognition system plays important role in real life applications such as automatic toll collections, traffic law enforcement, parking lot access control, and road traffic monitoring. VLPR system recognizes a vehicle's plate number from an image by digital camera. It is fulfilled by the combination of a lot of techniques such as image acquisition i.e. capturing the image of real image of plate localizing the license plate character segmentation i.e. locating and identify individual character on the plate, optical character r recognition. The recognition problem

is generally sub-divided into four parts are Image acquisition i.e. capturing the image of the license plate, Pre-processing the image i.e. localizing the license plate, Character segmentation i.e. locating and identifying the individual symbol image on the plate, Optical character recognition. A guiding parameter in this regard is country-specific traffic norms and structure. This helps to fine tune the system i.e. number of characters in the license plate, text luminance level (relative index i.e. dark text on light background or light text on dark background) etc. For example, in India the norm is printing the license plate number in black colour on white background for private vehicles and on a yellow background for commercial vehicles. Number plate is a pattern with very high variations of contrast. If the number plates is very similar to the background it's difficult to identify the location, Brightness and contrast is changes to it. The morphological operation reused to extract the contrast Feature within in the plate. The work is divided into several parts: 1. Input image 2. -Input Gray scale/binirazation 3. Reduce the noise using median filtering Method 4. Plate localization 5. Character segmentation 6. Character recognition

Vehicle license plate recognition System "has been intensively studied in many countries. Due to the different types of number plates being used, the requirements of an automatic license plate recognition system are different for each country. In this paper, a number plate localization and recognition system for Indian vehicles. This system is developed based on digital images and can be easily applied to car park systems for the use of documenting access of parking services, secure usage of parking houses and also to prevent car theft issues. Automatic license plate recognition system is to extract vehicle license plate from a digital image. The paper based on a combination of the IoT and Image Processing filling up the holes approach method with area criteria test for the number plate localization. Segmentation of the plate characters was achieved by horizontal and vertical scanning method. The character recognition was accomplished with the aid of optical characters by the process of Template matching. We mainly concrete on three steps: one is to locate the number plate, second is to segment all the number and to identify each number separately, third is recognize each character. The goal of this section is to elaborate on the methods of finding the vehicles plate's location in captured images. Generally a monochrome camera with a synchronous IR projector and a color camera are employed in a multi-purpose industrial ANPR system. The monochrome camera with IR projector is responsible for plate detection during the night or other low illumination conditions. It is worthwhile to note that for the IR projector to be effective the vehicles plates should have been coated with IR reflective materials. The role of IR projectors is also important in detecting dirty plates even in daylight by taking care of the camera exposure time. IR projector power has a close relation with the camera exposure time and the exposure time plays an important role in the final clarity of the vehicles plates. Since vehicles move swiftly, high values of exposure time lead to blurred images while low exposure time values produce dark images. Therefore, it is important to tune the output power of IR projector with respect to the exposure time of

the monochrome camera. It is also necessary to have an adaptive procedure to fine-tune the exposure time based on the lighting conditions. Modifying the exposure time is performed in an adaptive procedure that gets its feedback from the thickness of plate characters. Having thin characters is a sign of high ambient light. In this case, we must decrease the exposure time. On the other hand, achieving thick characters shows that the environmental light is low and we must increase the exposure time. The modification steps are dependent on the setup and application and must be found experimentally. For example, at sunrise, sunlight reflects from vehicles that move from east to west. In such cases, exposure time should be lowered down to a value that eliminates the reflections. A comparison between fixed and variable exposure time algorithms is demonstrated. Color cameras are needed to provide visual evidences for the violation scenes in order to support the corresponding traffic tickets. As discussed in the introduction section, there are many algorithms to detect the exact location of plates in an image. We have tried most of the algorithms proposed so far. All of these algorithms fail on dirty plates and the plates with low contrast between plate characters and the background. The major problem faced on the road that is in day to day increased vehicle population on the road. This strategy is however stressful and laborious because of the valuable time spend in a traffic; so this problem cannot sort out manually. There arises a need for a more efficient and effective method of solving this problem. The paper aim is going to solve of these problem by using raspberry pi 3 models. The Raspberry Pi is a credit-card sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools. The Raspberry Pi is manufactured through licensed manufacturing deals with Newark element 14 The hardware is the same across all manufacturers. The Raspberry Pi has a Broadcom BCM2835 system on a chip (SOC), which includes an ARM1176JZF-S 700 MHz processor (The firmware includes a number of "Turbo" modes so that the user can attempt over clocking, up to 1 GHz, without affecting the warranty), Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and long term storage.

2. LITERATURE SURVEY

Automation is believed to be the most frequent term in most area of electronics and intelligent systems. Due to automation, a revolution has occurred in the existing technologies. Identifying vehicles automatically has become necessary due to its several applications; for example, traffic surveillance, access control, parking fees and toll payments, ticket issuing, theft control, vehicles document verification, etc [1]. The task of identifying vehicle’s plate number using automatic recognition techniques can be seen as an important research area of the modern automation system and intelligent transportation system which has been widely studied for several decades [2-3]. In many countries, the formats of licensed plates often differ but the techniques of automatic

recognition can be the same (detection, segmentation, and character recognition). From the three key automatic recognition techniques, the most crucial task is to detect the license plate and failure of which will greatly affect the accuracy of the recognition. According to [4], edge-based methods seems to be popular and widely accepted. The second task after detection is character segmentation, where the captured characters are segmented according to their height and width values. Projection method [5] is believed to be a highly effective method of character segmentation used for most plate number recognition. Character recognition is the last stage and once the license plate is well segmented in-line with the frame of the license plate into a separate of blocks. Different methods can be used to achieve this, such as; template matching [6], corner detection algorithm [7], Neural Networks [8-10], Raspberry Pi [11-13], etc. In this study, raspberry pi is the heart of the system. In many industries environment, unknown vehicles are not allowed. Security is of high importance hence this study will help to recognize the plate number of vehicles approaching at the gate by allowing security officials to automatically verify the plate number of vehicles entering and exiting seamlessly. Thus, confirming the identity of the owner and the vehicle's particular through the system stored information. The recognition of the vehicle number plate is in four steps. The first is image acquisition, second is license plate extraction, third is license plate segmentation, and last is character recognition. The work reported in [6], address a robust approach of license plate detection and recognition that is based on Hough lines with the use of Hough transformation and template matching. It was developed for Islamabad standardized vehicles plate numbers. In the proposed ANPR technique, two modules (License plate detection module using the Canny detector and Hough transformation) were used. The result of the experiments on 102 samples from different scenes under various illumination conditions showed that ANPR scored 89.70% for all the number of plates considered. Character recognition technique using the Harris corner algorithm was proposed in [7], to capture plate number image even in changing motion and illuminated lighting conditions. In the approach, the segmentation stage is accomplished by connecting the component analysis consolidated with Pixel count, Aspect ratio and the Height of characters. The results obtained from the experiments for proper license plate identification was 96.92%. In [8], a weighted statistics method to make a number plate images in a more prominent position was presented using Neural Network (NN). Thick grid feature extraction and momentum BP neural network algorithm were combined to distinguish the license plates. The experimental results show that the method improves the accuracy and the speed of character recognition. The research in [9] also proposed the use of a neural network algorithm. In the study, a unified ConvNet-RNN model that can recognize the captured license plate and a Convolutional Neural Network (ConvNet) to perform feature extraction was used. The experimental results from the approach in comparison with a sliding window-based approach showed that the approach outperforms the window-based approach scoring over 76%

accuracy in recognizing plate number characters with a per character accuracy of about 95.1%. In the work presented in [10], the core technology of the system (Sight hounds license plate detection and recognition system) was developed using deep Convolution Neural Networks (CNNs). The CNNs were trained and fine-tuned for better performance in different conditions and for varieties of license plate numbers. For quantitative analysis, we show that our system outperforms the leading license plate detection and recognition technology i.e. ALPR on several bench-marks. The use of Raspberry pi for automatic license plate recognition was proposed in [11], the study explores the use of Optical Character Recognition (OCR) to extract the images of license plate captured by the camera. The captured is processed by the segmentation of the characters and verified for authentication by the Raspberry Pi. The study is similar to the approach used in our study although our algorithm is considerably different. The results of the experiment showed an accuracy of 96%. Other interesting research on the use of Raspberry pi is reported in [12-14]. In the work in [15], the number plate recognition method used was Color Edge Detection and fuzzy maps. The steps taken were Pre-processing which consist of binarization using a variable thresholding technique then Connected Component algorithm was applied to binarized the plate numbers to eliminate the undesired area. Also, Huge transformed was used for alignment of extracted components for further process. The OCR (Optical Character Recognition) was another step in which the character recognition process took place and the task of character categorization accomplished by the compositional semantics of license numbers, Topological Shorting to compute the topological features of characters for further process. Then the self-organizing Template test was performed to match the input character to the database and the best match was found. Experimental results performed on 1601 images give an overall success rate of 93.7%. In [16], Sauvola Method and Sliding Concentric Windows (SCWs) segmentation techniques were used for faster detection of the region of interest (ROI). The character recognition task was done by Trainable OCR (Optical Character Recognition) system based on Neural Networks which used the approach of PNN (Probabilistic Neural Network) with two individual probabilistic networks. The Experiment was performed on 1334 images and the segmentation rate was achieved around 96.5% and With the PNN approach plate recognition recorded 89.1%. The overall rate of success achieved was 86.0%. The algorithm for number plate recognition was described in [17] with Pre-processing and Plate Recognition as the main steps which help to improve the image quality by converting the colored image to grey level using Standard NTSC model and median filtering. Feature-based number plate localization method was implemented for further processing. Edge detection, resembling, thresholding and filtering Image processing technique was applied for localization and isolation of the license plate and the characters. The results under varying illumination conditions show a success rate of about 80%. In the work of [18], an automatic vehicle license plate recognition using artificial neural networks

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was proposed. The vehicle plate images were taken from a CCD camera while the image pixels were determined using image processing algorithms. Canny edge detection operator and the blob coloring method were for image recognition. As a result, 247 license plates in 259 vehicle image were recognized correctly in this work, so the overall recognition percentage of the system is 95, 36%. Another interesting research on License Plate Recognition (LPR) is as reported in [19-23].

3. EXISTING SYSTEM

In existing framework we utilized nuberplate recognisation using YOLOv3 algorithm.. This have following limitations. To overcome all we are using integrated OCR based number plate recognisarion

- No random images (cat, dog, etc.) for training purpose of the Detection model
- No other vehicle considered other than cars in training (unavailability of the dataset)
- As Tunisian data has been used all through the problem, OCR is able to understand digits but not characters (Arabic language)
- Bad quality images (blur, incomplete, etc.)
- No video data.

4. PROPOSED SYSTEM

The challenges faced by traffic law enforcement agents in Nigeria to bring unlawful vehicles to justice formed part of the reason for this study. We seek to eliminate the challenges using our vehicle recognition system which uses Open CV and OCR in capturing and identifying the vehicle plates. The system makes use of an onboard computer, which is commonly termed as Raspberry Pi. The onboard computer can efficiently communicate with the output and input modules which are being used. The Raspberry Pi is a credit card-sized single-board computer interfaced with 2MP Pi Camera and a 3.5" Touch Screen for display. The Vehicle Plate image is captured with the help of the interfaced 2MP Pi Camera and its being stored in an SD card memory for preprocessing and recognition. After the preprocessing is done by the initiation of the OpenCV, the characters on the plate are recognized using the Optical Character Recognition (OCR) and the corresponding characters found on the plate are displayed.

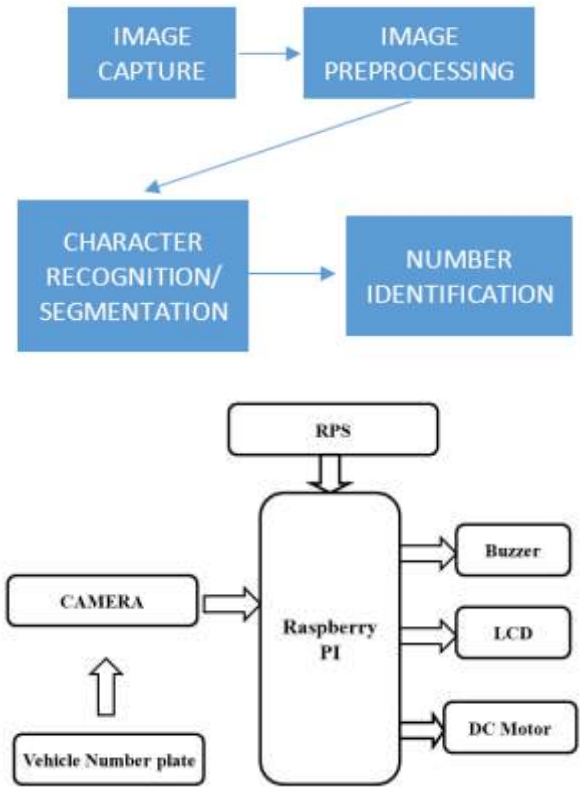

Fig.1. Proposed block diagram

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WORKING MODEL:

Initially we need to connect Raspberry PI to the hotspot, the mobile hotspot should be with Project user and Project1234 password then the board will be connected to the hotspot. Then we need to do ip scan to get the ip with advanced ip scanner. Login to the ipwith VNC viewer where the Raspberry PI application is running with pi as user and 12345 as password. Before getting into it we need to maintain the vehicle data in database with txt file with small letters of vehicle number, Ex: wb06f5977.txt. In the project whenever a vehicle enters nearby gate the IR sensor will sense the object and allows camera to take the picture, The LCD presents the status as taken picture.

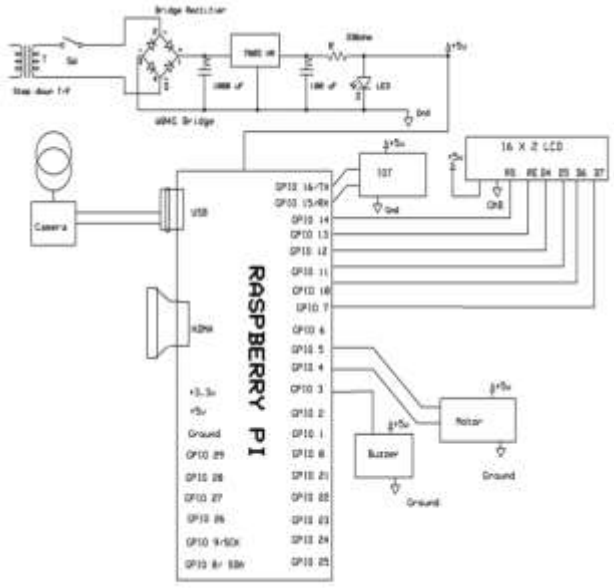

Fig.2. Proposed Circuit diagram

Once the picture taken the Raspberry Pi will do image processing to match the data base with vehicle number with the help of OCR and OCV technologies, If the vehicle number plate matching the database, then it allows the vehicle by opening the gate with LCD presentation of ACCESS GRANTED WELCOME. If the vehicle number plate not matching the database, then it will give a buzzer with LCD presentation of ACCESS DENIED NO ENTRY.

In this project we are using Broadcom BCM2837 Microcontroller. It has total 32 pins.GPIO 3 connected to Buzzer with 5v supply, GPIO4 and 5 connected to Motor. GPIO7,10-14 connected to 16*2 LCD display, GPIO 15 and 16 connected to IOT.

5. RESULTS

Here the circuit is turned ON by giving the regulated power supply of 12v which is then converted to 5v dc current. The LED is the indication for 5v current so, if there is 5v current then automatically the LED glows. The generated 5v dc current passes to every hardware component in the circuit.

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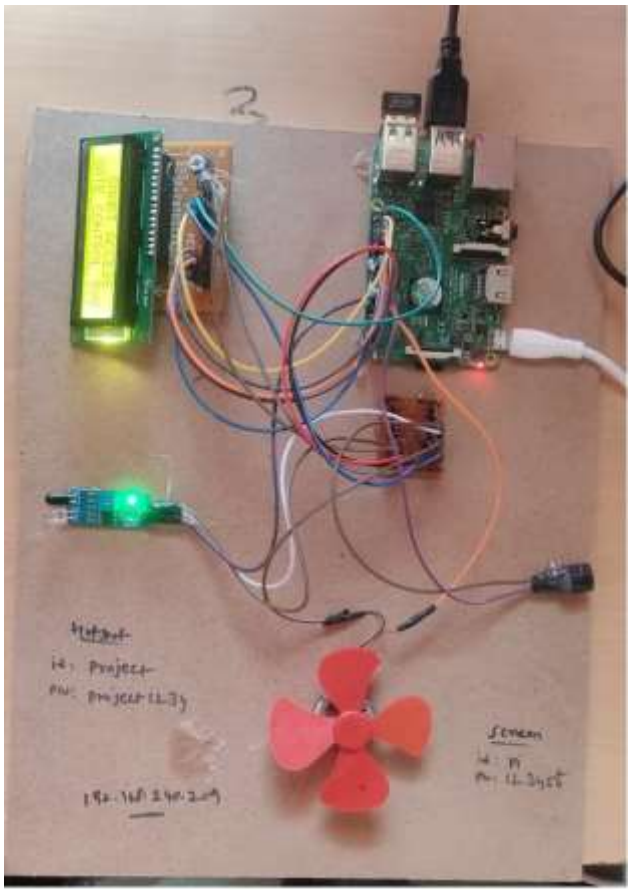

Fig.3. Proposed Output model

Here in Raspberry Pi it is scanning the vehicle number and analyzing the data which is matching our database or not, as it is showing the vehicle number as true which means the data is matching will allow the vehicle by opening the data

Fig.4. LCD Output Level Indication

Here the vehicle number is matching the database and giving the access to vehicle by opening the gate to allow the vehicle with this display

Fig.5. LCD Monitor Numberplate

Here the vehicle number is not matching the data base and refusing the vehicle to not allow by giving buzzer along with presenting this display note.

Fig.6. LCD Denied Output Indication

Table.1 Results comparison Table

Parameter	Existing Model	Proposed Model
Microcontroller	ARM	Raspberry Pi
Speed	Low	High
Complexity	High	Low
Efficiency	LOW	HIGH

6. CONCLUSION

W e designed and the development of the vehicle plate recognition system shows how the use of the Open CV and OCR can be applied in the character extraction and recognition of vehicle plates. Although, this design is just a proof of the concept (prototype) and hence, includes the very initial step in a study that has the potential to be expanded in the future. In order to improve the design efficiency, other forms of character extraction and recognition technologies will be examined. We accessed the vehicle as per the number plate reorganization using opencv and raspberry pi processor.

REFERENCES

[1] Zang, D., Chai, Z., Zhang, J., Zhang, D., & Cheng, J. (2015). Vehicle license plate recognition using visual attention model and deep learning. Journal of Electronic Imaging, 24(3), 033001

[2] Sirithinaphong, T., & Chamnongthai, K. (1999). The recognition of car license plate for automatic parking system. In ISSPA'99. Proceedings of the Fifth International Symposium on Signal Processing and its Applications (IEEE Cat. No. 99EX359) (Vol. 1, pp. 455-457). IEEE.

[3] Wang, J., Bacic, B., & Yan, W. Q. (2018). An effective method for plate number recognition. Multimedia Tools and Applications, 77(2), 1679-1692.

[4] Al-Ghaili, A. M., Mashohor, S., Ramli, A. R., & Ismail, A. (2012). Vertical-edge-based car-license-plate detection method. IEEE transactions on vehicular technology, 62(1), 26-38.

[5] Qin, Z., Shi, S., Xu, J., & Fu, H. (2006). Method of license plate location based on corner feature. In 2006 6th World Congress on Intelligent Control and Automation (Vol. 2, pp. 8645-8649). IEEE.

[6] Rasheed, S., Naeem, A., & Ishaq, O. (2012). Automated number plate recognition using hough lines and template matching. In Proceedings of the World Congress on Engineering and Computer Science (Vol. 1, pp. 24-26).

[7] Panchal, T., Patel, H., & Panchal, A. (2016). License plate detection using Harris corner and character segmentation by integrated approach from an image. Procedia Computer Science, 79, 419-425.

[8] Zhang, Z., & Wang, C. (2012). The research of vehicle plate recognition technical based on BP neural network. Aasri Procedia, 1, 74-81.

[9] Gao, P., Zeng, Z., & Sun, S. (2018). Segmentation-Free Vehicle License Plate Recognition Using CNN. In International Conference on Signal and Information Processing, Networking and Computers (pp. 50-57). Springer, Singapore.

[10] Masood, S. Z., Shu, G., Dehghan, A., & Ortiz, E. G. (2017). License plate detection and recognition using deeply learned convolutional neural networks. arXiv preprint arXiv:1703.07330.

[11] Sundararaman, V., Vijayalakshmi, T. G., Swathi, G. V., & Mohapatra, S. (2016). Automatic License Plate Recognition System Using Raspberry Pi. In Proceedings of the International Conference on Recent Cognizance in Wireless Communication & Image

Processing (pp. 217-222). Springer, New Delhi.
[12] Thangam, E. C., Mohan, M., Ganesh, J., & Sukesh, C. V. (2018). Internet of Things (IoT) based Smart Parking Reservation System using Raspberry-pi. International Journal of Applied Engineering Research, 13(8), 5759-5765.