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SMART PARKING SYSTEM USING VISION SYSTEM FOR DISABLE DRIVERS (OKU)

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ABSTRACT

Vision based systems have been used widely for various purposes that includes parking management, highways and industrial applications. In this paper smart parking system for disabled people has been developed based on vision technology. To accomplish this recognized image undergoes several pre-processing phases. Since the proposed system focuses disabled people therefore RFID tag detection feature has also been introduced for ticketless system that would store information of the parked vehicle and automatically deduct some balance on the base of duration. In the pre-processing phase several techniques have been applied such as Gaussian blur, Otsu binarization and Threshold INV. For the recognition of pattern K-Nearest Neighbour algorithm (K-NN) has been used for OKU sticker recognition. After the successful implementation of the system it has been tested out for evaluation and analysis under different lightning conditions and scenarios. Through collected data it can be concluded that the developed system performs efficiently in different lightning conditions by providing accurate results.

Keywords: parking, vision system, theorem proving, parallel algorithm, extension rule.

INTRODUCTION

In recent years, car parks for disabled people have become a problem in cities or rather towns with a growing proportion of automobiles. Along with the ever so evolving issues of car parks for disabled people, the regular car parking system for the disabled does not deliver any sort of data or rather information that would inform a disabled vehicle user whether the parking that is a short distance away available or occupied.

One of the major issues in the world is illegal use of handicapped parking. OKU is Malaysian term meaning person with disability. International logo for OKU parking is mounted high enough so that it can be seen clearly from a distance. But some people tend to abuse the disable parking as the driver want to park near the entrance and to avoid walking which has increasingly creating problem for the disable users/drivers. As such action is utterly non-ethical and not acceptable in the society but continues to grow day by day. This project was developed to aid the disable driver for more convenient parking and easy access to the building. Since the most car parking already have OKU parking bay, the project is to utilizes the available parking bay with minimum change to the infrastructure. The main is to introduce a separate OKU parking bay for disable drivers to move around that is why separate parking bays are allocated for them near the entrance and exit of shopping mall, hospitals, colleges etc. disable people need wheelchair to move around for that extra space for OKU drivers is required.

A simple solution to this unnecessary flooding of cars in a disabled car park zone is to introduce a vision based system whereby at the entrance barricade there would be a camera that records the entrance and exit of vehicles. Along with that normal system it would detect a specific sticker that would be attached to the windshield of the disabled car user. The camera detects the sticker on said vehicle, and then runs a scan through the system to ensure if the sticker is in fact legal, if system approves, it will allow said vehicle to pass.

The aim of the project is to design and develop smart parking system using vision system for disabled drivers (OKU) to facilitate disable people by securing their private parking bays without changing the current infrastructure and only adding automated barrier.

Smart parking system for disable people is expected to provide social benefit especially for disable drivers and enhancement of parking management system. By securing disable parking spaces customers would be able to park their vehicles instantly instead of searching for available space in congested traffic area. The proposed system is fully based on pattern recognition algorithm. To do so camera mounted at parking entrance would capture the image and extract the required information for further pre-processing.as some people tend to ignore the disable parking logo for their convenience, with the implementation of proposed system selected parking bays would be completely secured for only authenticated person.

For smart parking system number plate recognition is vital to identify vehicle at parking entrance because for each car vehicle number plate provides particular information. In this approach applicant's district of vehicle number plate are identified relatively on the basis of vehicle number plate management that includes numbers, pattern of characters colour, model and ratio of the license plate etc. [1-3].

RFID system that consists of device mounted inside the vehicle and aiding infrastructure is developed to allow accredited vehicles and drivers to restricted areas that includes private parking facilities, airport and offices etc. the device installed in the vehicle verifies to the modified infrastructure using present digital certificate whereas drivers verify over digital certificate stored in the smart placed into the device [4].

METHODOLOGY

In this section three different block diagrams are shown. The first block diagram in Figure-1 shows the methodology of existing block diagram. The second Figure-2 shows block diagram of proposed methodology required to meet the objectives during the investigation phase. Third figure shows the final block diagram of the proposed system. It is visible in the established and implemented methodology that there are some modifications in the proposed methodology.

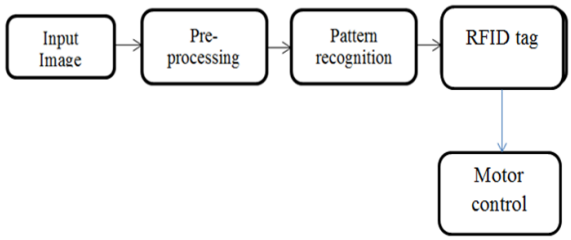

Figure-1. System working diagram.

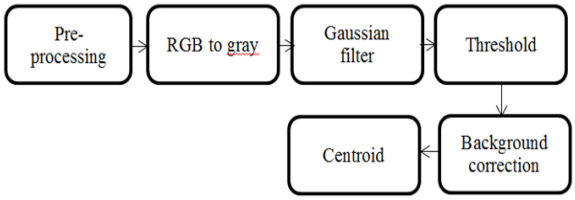

Figure-2. Diagram of pre-processing phase.

In this block diagram input image is first converted into gray scale image. Secondly Gaussian filter technique is applied to remove the noise in the captured image to obtain the desired output. In the next stage two types of threshold techniques have been applied the inverse threshold and Otsu threshold to convert the grey scale image into binary image. This technique will enable the system to recognize the pattern faster with higher accuracy. In the final phase of pre-processing centroid algorithm will be applied that returns coordinates to the center of the OKU sticker.

In the third block diagram additional feature is added to develop the system that is use of RFID tag. The main reason to introduce this feature is to provide and develop convenient and efficient system for disable people. In this phase user is asked to display the RFID card that will store the personal information of the vehicle. After recognizing the OKU sticker developed system automatically verifies second condition that is authorized RFID tag reader. The reason to introduce RFID tag is to provide disabled people with ticketless system that will enable the disable driver to park their vehicles without collecting tickets. Drivers can simply display the card at some distance and there stored data and duration of the parking will be recorded as well. On the base of entrance time and exit time balance will be deducted from the card automatically by displaying remaining balance and duration of parked vehicle.

Python is such a type of programming that is used to interface with raspberry pi controller. Python is slower compared to some widely used languages such as C/C++ but another major python feature is that it can be extended easily with C/C++. Features like this allows user to create comprehensive computation codes in C/C++ and build its python wrapper so that user can later use this as python module. There are two main advantages of having this feature first is that the performance of the code is as fast as C/C++ original code and secondly it too simple.

Another important feature is the whole system is controlled by raspberry PI and the image processing part is done by the Opencv software which can be integrated with the PI controller.

Pattern recognition

After obtaining pre-processed image it has to be recognized to perform certain function. Initially supported camera is turned on in grayscale mode. Reason to do so is that it the image that has to be recognized will be clear that makes the system fast and efficient. Therefore, for OKU sticker recognition K-nearest neighbour algorithm has been used. K nearest neighbour can easily be defined as an algorithm that stores all the provided spaces and allocates new cases on the basis of similarity measure for example distance functions. KNN has been used excessively for pattern recognition and statistical estimation since 1970s [5]. It is a non-parametric algorithm used for both regression and classification. In both cases, input contains the nearest K training samples in feature space. In K-nearest neighbour algorithm system compares the image with the samples taken and on the base of attached samples to the program it recognises the sticker. Several different samples were taken at different angles to train the system for pattern recognition. These sample images play vital role in pattern recognition for system. The moment camera finds a clear picture of the image that has to be recognised in certain range it will instantly recognise it and capture image for further processing.

Classification

Output represents class membership in KNN classification. Normally objects classification depends on its neighbour majority vote with object that has been assigned to most common class between its k-nearest neighbours.

Contours

Contours simply can be represented as curve joining all the extended points having similar intensity. Contours are one of widely used tool for object recognition or detection. Using contours approximation method the outline borders of the stickers are found as show in Figure-3.

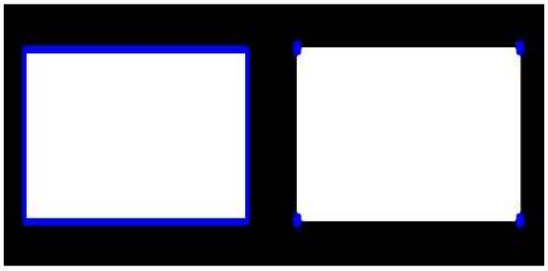

Figure-3. Contour NONE and SIMPLE difference.

EXPERIMENTAL RESULTS

This part basically contains simulation results obtained from testing the developed system. It involves simulation results of the system under different lighting conditions and scenarios. By performing these tests efficiency of the system can be analysed on the base of obtained simulation results. Furthermore, Figure-4 shows the original OKU sticker that has to be recognised. In this sticker developed system has been trained to detect two patterns that are wheel chair logo and OKU alphabets or text as shown in Figure-5. As soon as the system detects any of the mentioned pattern camera will capture the image for further processing. If the system detects wheel chair logo it will display "W" else it will display "T" after the recognition meaning text OKU has been recognised.

Figure-4. Original OKU sticker recognition testing under room light close range.

Figure-5. Wheel chair logo and the OKU text.

In Figure-6 the first testing of the system is performed under normal room light condition. From result obtained it can be observed clearly that camera is able to visualize the OKU sticker and recognise it. In this particular test OKU sticker was placed approximately (5cm–15cm) away from the camera to analyse camera ability to recognise the sticker.

Figure-6. Recognition testing under room light close range.

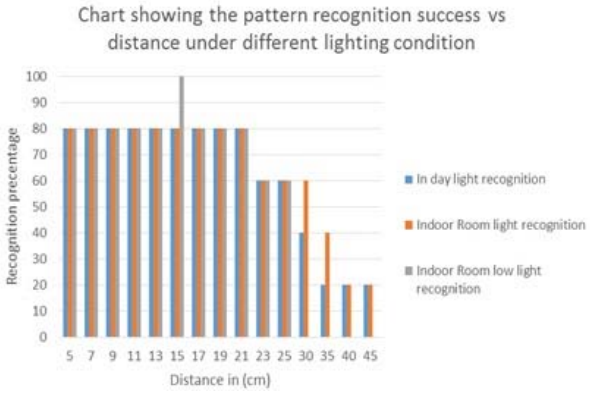

Figure-7. Image recognition results.

From chart in Figure-7 above it can be seen that the result is good for in-door and outdoor detection the detection is around 80%. The limitation of the system is that the range is only around 25 cm. This is because the system was tested on a webcam. It is expected with a better quality camera this distance can be improved.

CONCLUSIONS

For this particular implemented project several contributions exist. The existing systems which are commercially available uses PCA techniques for pattern recognition whereas in the developed system methodology K-NN algorithm has been adapted in term of methodology contribution. In term of pre-processing stage Gaussian filtration technique and Otsu binarization technique has been used to minimize background effect. In the developed system RFID technology has also been introduced to provide fully automatic and ticketless system for disabled people that does not exists in the present system. With the combination of different techniques and pre-processing phases integrated algorithm for pattern

recognition has been established. The last contribution to this project is made in testing and evaluation part. The developed system has been tested in different lightning conditions and under different scenarios to analyse the performance of the system. From the collected it can be analysed that the system performs efficiently in almost all conditions. This contribution will allow researchers to enhance the performance of the system in future development for outdoor conditions and could be implemented anywhere required.

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