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## License Plate Recognition System

### 1 Objectives

The objectives of this project are to know the techniques, tools and elements of a vision system to make an application for vehicle license plate recognition through LabVIEW programming.

From different processing image techniques, the image is prepared to be analyzed. Next, using extraction methods, the license plate is located and later, OCR is applied in order to find the license plate alphanumeric code.

The system lacks external illumination, and this is why algorithms have been added to deal with difficult images.

The developed application can acquire images from different sources: webcam cameras, generic frame grabbers, Firewire 1394 cameras or images files.



Figure 2 Valid camera positionation



Figure 1 Block diagram of the system

### 2 Image acquisition

The system has initially been developed with a webcam as the device for capture images to reduce the cost and to allow the portability, but if other devices are connected, the source can be selected.

The image acquisition in LabVIEW is made with the functions of NI-IMAQ library, but this library does not allow acquisition from webcam cameras or generic frame grabbers. This problem was solved reprogramming a free code distribution of acquisition cameras and compiling it into a DLL to be able to be used in LabVIEW.

The basic characteristics we sought for the webcam were that it had a wide angle of view and a CCD sensor (this type improve the system indirectly to allow clearer images with little illumination) in comparasion to CMOS sensor. Another important desired characteristic is that it had an automatic control exposition.

### 3 Treatment of the image

The method known as scale amplitude is applied because the improvement that it introduces and facilitates the detection of the edges of the objects, which is one of the used techniques later used to detect the license plate.



**Figure 3** Results of scale amplitude method

Due to the low signal noise relation of webcam cameras, an algorithm was implemented to eliminate the Gaussian noise. The method consists of obtaining the average of 20 consecutively made captures. The disadvantage of this method is that during the time inverted in making all the captures, the vehicle must be stopped.

This filter has been implemented so it can be activated or deactivated. In this way, if the light conditions are favorable and the effects that the filter introduces are minimum, it will be possible to be deactivated and win in speed processing time.

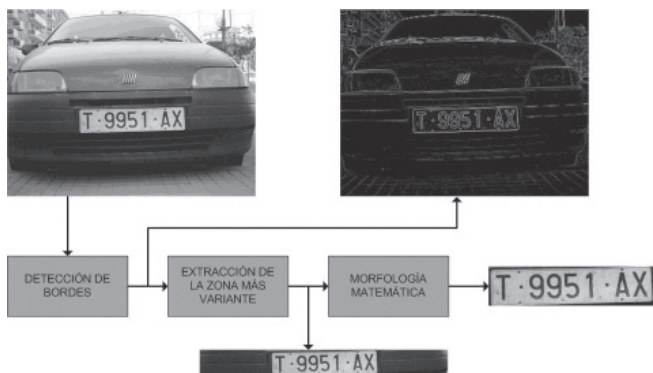
#### 4 License plate extraction

In order to locate the license plate, the edge detection (Sobel operator) is used. After different applied tests it was observed like the zone where a greater number of contrast changes exists, corresponds to the license plate place.

If we cut that zone, we obtain the upper and lower plate limits. To obtain the right and left limits mathematical morphology is used.



**Figure 4** Number of contrast changes applying Sobel operator



**Figure5** Block diagram of the method to locate the license plate

#### 5 Optical Character Recognition

Designed algorithms are applied beforehand to facilitate the work of the OCR. These algorithms consist on finding and correcting the inclination of the image making the median of all the angles of the found objects in the plate.

The bookstore of the OCR, has been generated with the groups of the used license plates characters in Spain. Also, new characters have been added to improve the detection of degraded characters.



**Figure 6** Different characters that represents number eight

#### 6 Conclusions

A low cost vision system that is able to recognize the license plate alphanumeric characters has been designed and implemented.

All the system has been programmed in LabVIEW and a free code distribution has been used to acquire images from webcam cameras.

It has been proven with 136 vehicles giving good results: recognition of plate 100%, recognition of characters 95.93%. This experiment was made under ideal environmental conditions but the system also has worked correctly with little light due to the designed algorithms.