An Artificial Intelligence System for Monitoring and Security for Vehicular Plate Number in Lyceum of the Philippines University – Laguna

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Abstract: This paper describes a project for the design and implementation of Automatic License Plate Recognition in Matlab. ALPR plays an important role in terms of Security and surveillance which also provides cumulative application access control, traffic control and detection of stolen vehicles. Since the project is OCR driven, it is divided into different stages of image manipulation to provide an accurate output of processed license plate number. Visual Basic .Net is used as the face of the system for the signal and notification controls of authorization and is linked to OCR in Matlab. The use of ALPR requires a specific horizontal and vertical alignment for precise recognition of plate number. ALPR, generally, is used in public works and highways, in this project, the proposed system will be implemented in private sectors, specifically in an Educational Institution.

1. INTRODUCTION

The security is one the main proportions to make the life inside of an institution sustainable and well functional. Our nation's schools and universities are faced with ongoing threats such as violence, drugs, bullying, crime, natural disasters and even terrorism. (Web – 1) In order to reduce the risk of the phenomenon, the security of the institutions must be well maintained. Most of the educational institutions around the Philippines have parking lots for students and teachers that provide a convenient place to park and enter or leave campus. Most of which have security cameras installed to help secure the premises. Placing cameras in front of the Main gates will help alert school security guards to suspicious behavior around the cars and can help police pursue suspects if anything is stolen or vandalized.

1.1 Background of the Study

In this study, an integrated ALPR will be used in a system with the help of designed interface in Visual Basic .NET for the increased of security in LPU – Laguna. Lyceum of the Philippines University – Laguna (LPU – L) have security cameras installed in some designated areas but Main Gates does not have any and Main Gates that are not monitored digitally can increase the risk of danger for students and faculty. And for some instances, visitors or outsiders with personal vehicles can enter the school premises without the permission of the guards on duty. This means that the security of the institution is below average (Sharma et al., 2014).

A properly secured institution or area is consisting of materials intended for security purposes to attain a sustainable environment. Such materials include Surveillance camera, which are common nowadays for it increases the security of a certain area and its common function is to record videos for crime prevention, traffic monitoring and many more. For example, major expressways have an advanced security materials installed in every toll plaza to monitor vehicles. This includes the automatic acquisition of vehicles' plate number through the use of surveillance cameras in case some disturbances occur.

1.2 Problem Statement

The Lyceum of the Philippines University – Laguna since it was established and began to operate is still managing in manual labor type classification. Partial areas of the campus have accomplished increasing the security but the Main Gates is still without a proper security system and thus increasing the risk of danger of the institutions and its people.

1.3 Objectives

The prime objective of this study is to create and develop a plate number recognition using the MATLAB Image Processing toolbox with Visual Basic .NET interface for the

Main Gates of Lyceum of the Philippines University –
Laguna. This study aims to:

a.) To develop an intelligent system that can provide
security and safety by acquiring the plate number
of vehicles coming in and out of the campus
b.) To develop a Visual Basic System Interface for the
control of monitoring procedure and data
procurement process
c.) To test the performance and reliability of the
prototype and the system.

2. METHODOLOGY

2.1 Visual Basic .net

Visual Basic was introduced as the first programming
language that supports programmable graphical user
interfaces (GUI) using the language-supplied objects. An
object-oriented language that consists of two fundamental
parts. First is the visual part it is consist of a set of objects
and second is the language part which is consists of high-
level procedural programming language. These two elements
were combined to create a different application which is
usually seen inside the desktop. (Web – 2)

2.2 MATLAB

MATLAB is one application that has a high-performance
language for technical computing. It can be used for
computing, visualizing, and programming an easy-to-use
environment where the user can solve the problems easily,
fast and legibly. It is also a communicating system whose
basic data element is an array which doesn't required any
dimensioning on the system. It is good in solving matrix,
vectors or even a fraction to make the results simpler and
accurate. (Web – 3)

2.3 Arduino

A pre-assembled Arduino board includes a
microcontroller, which is programmed using Arduino
programming language and the Arduino development
environment. In essence, this platform provides a way to
build and program electronic components. Arduino
programming language is a simplified from of C/C++
programming language based on what Arduino calls
"sketches," which use basic programming structures,
variables and functions. These are then converted into a C++
program (Web – 4).

Figure 2.4 is the main component of the system where the
data is being processed. Arduino served as a controller and
identify whether the inputted plate number is a regular or a
visitor on the institution.

2.4 PROPOSED SYSTEM

The system aims to prove the possibility of integration
and implementation of ALPR in LPU – Laguna to increase
the institutions' safety and security. The system used the
Matlab intended for vehicle's plate number and Visual Basic
.NET for the interface providing signal and notification
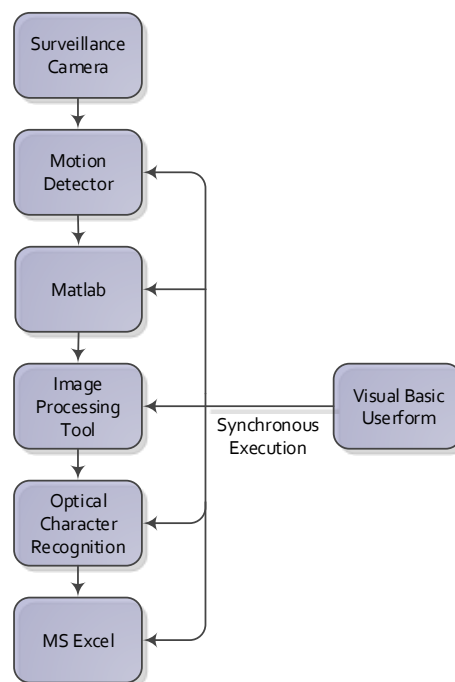controls.

Figure 2.5 BLOCK DIAGRAM

Figure 2.5 is a simplified block diagram of the system application. Since the system is for security purposes, the interface in built with username and password. The interface is designed with a homepage/home screen and the main controls is built in another form wherein the main functions of the system is provided. When the plate number is entered, the system will search the database if the input is regular in the institution or a visitor. The system will notify the user when the plate number is a visitor and will be prompted to be added on the database of not.

Figure 2.6 IPO Chart
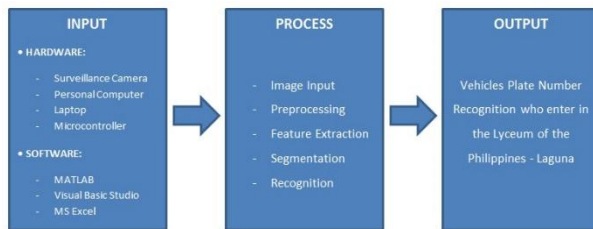
Figure 2.6 Shows the flow of the system and its application has been stated. The system will capture a vehicle plate number and serve as a data, this data will be process with the help of MATLAB Image Processing Tools and undergo a different steps in order to obtain the desired information. After the process and manipulation the system will produce an output and save it to the MS Excel application for security and future use.

A database linked to the visual basic interface will be provided for the saving of the plate numbers. Included in the database is the list of vehicles' plate numbers allowed and recognized by the administration of LPU – Laguna.

2.7 PSEUDOCODE

1. Start
2. ALPR Form
3. User Log-In
   - Input value for security purposes
4. Account Verification
5. Choose Recognition
6. Input plate number
7. Choose incoming or outgoing
8. If incoming, the system will notify if regular or visitor
9. If regular, time logged in will be recorded
10.
11. If visitor, the user is prompt to add to pending list or not
12. If outgoing, time logged out will be recorded
13. End

Figure 2.8 Flowchart
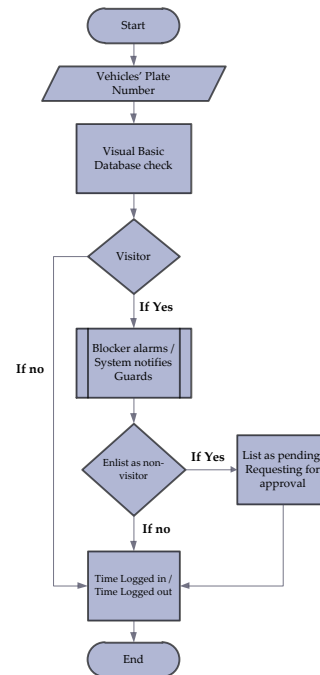
3. RESULTS AND DISCUSSION

3.1 Project Description

This system is made using Matlab and OCR integration and Visual Basic .NET to provide an efficient security system for LPU – Laguna also to increase its safety. The system is run through an integrated algorithm of OCR designed in MatLab and is linked to the designed interface dedicated for signal and notification controls.

3.2 Tools and Methodologies of the System
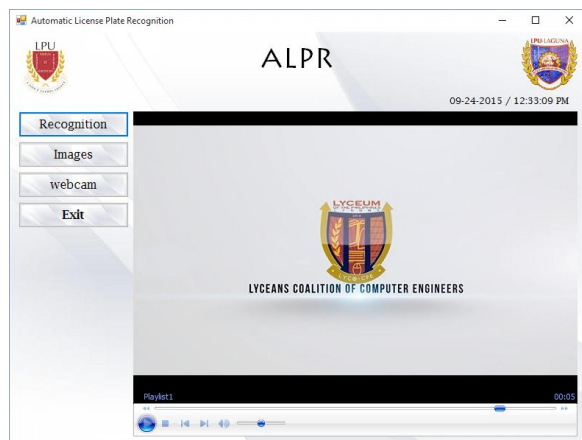

Figure3.2.1 System Home Page

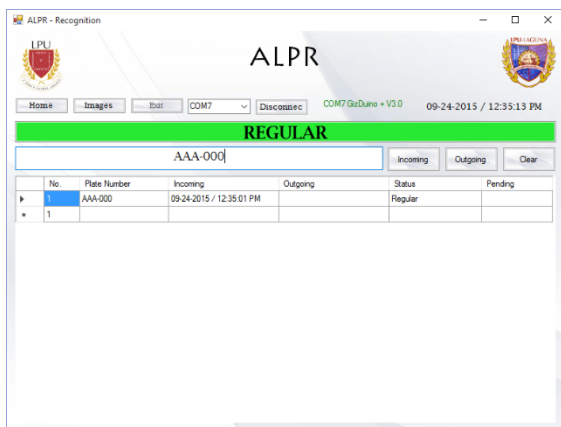This is the homepage of the designed interface wherein the recognition, images and exit tab is available.

Figure.3.2.2 Regular Notification - Incoming

When the inputted Plate Number is regular or is registered to the Administrations' records, the form will notify "Regular" and will also signal the Arduino to flash the Green Traffic Light. The time logged in will be recorded in the "Incoming" column.

Figure.3.2.3 Prompt - Pending

When the inputted Plate Number is not on the records of the Administration, the form will notify "Visitor" and will also signal the Arduino to flash the Red Traffic Light. The time logged in will be recorded in the "Incoming" column in the vehicle is entering the premises.
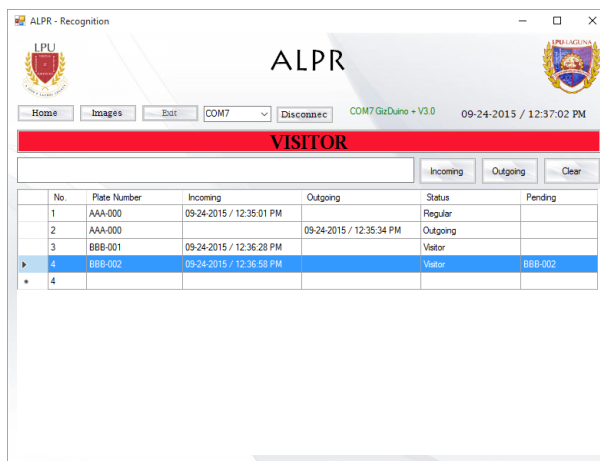

Figure.3.2.4 Visitor Notification – Incoming Pending

If the owner of the inputted plate number wants to enlist as regular, the status will be recorded as "Visitor" and also the time logged in and the inputted plate number will also be recorded in the Pending column aligned in the time recorded.
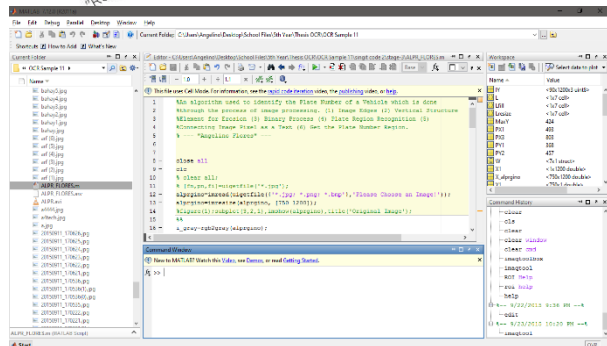
Figure.3.2.5 Matlab User Interface

This figure shows the entire software application used in processing the image taken by the camera. This is the algorithm that identifies and analyzed the supplied image and output the region of the plate number.
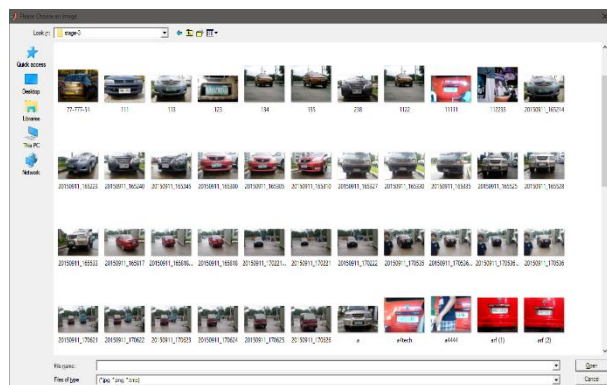

Figure.3.2.6 Matlab Image Directory

This is where the captured image stores, the images are compiled and run by the Matlab in this directory. It is very important to specify your target image directory to avoid the error and malfunction as well as the disruption of the whole process.
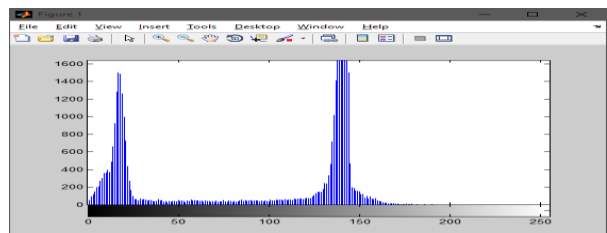

Figure.3.2.7 Image Histogram

A sample of RGB Image Histogram where the system is considering in order to get the most number of pixel in the image in order to identify the plate number region of a vehicle.

Figure.3.2.8 Image Filtering

A stage where the RGB Image is converted to a Grayscale Image as part of the pre-processing of the system.

Figure.3.2.9 Image Binarization

The input image was converted to a binary by thresholding, getting the image edges and eroded, then the morphological images has been made to identify the plate region of a vehicle.

Figure.3.2.10 Plate Number Region

After the pre-processing, thresholding, and binarization of an image the extraction of plate number region from the RGB image was the next step.
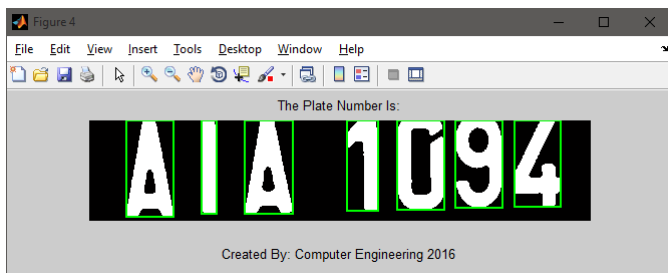

Figure.3.2.11 Output Plate Number

This is the final process of the system wherein the plate number region was converted into grayscale, threshold and the final step was the graythresh. In order to identify the character easily bounding box was used.

4. CONCLUSION

The system was made and developed by the proponents to record the incoming and outgoing vehicle who passes the vehicular gate of the institution.

The system is working in a proper camera placement within the required distance to capture the front view of the vehicle. The lighting, vehicular position, camera placement and plate number positioning have a big effect on detecting the plate region of a vehicle. These are the reason why the proponents set a stop box mark where the vehicle should touch to clearly identify by the camera.

The detection of the system was successfully done with a proper set-up of camera's range from the target image. The background or environment is a big dilemma of the system therefore the camera is enclosed to the vehicle and as much as possible no other images will be captured just the parts of the front view of the vehicle. The plate number can be detected even on the sideways view as long as the target region is at the centered of the image.

5. RECOMMENDATION

The system is in a good working condition considering the factors that may affect the process of detection. The proponents suggest that in order to get more accurate and reliable image and plate numbers consider a high definition type of camera or capturing devices. Image capturing and video recording must be at least minimum of 16 megapixel. The blocker is one of the best equipment that can be used instead of stop marking box that the proponents used.

To further maximize the efficiency of this project the next researcher must spend a lot of time in doing research, reading more related literatures and conceptualizing the possible limitations of this project. One recommendation for the next researchers is that action camera is a best medium for this kind of project, take the whole region of the front vehicle and make sure that the background is lessen. Another improvement that can be done for the system is building a templates depend on the characters that supports the plate numbers. The scope and limitation of the proponents can be widen and improved considering the different position of a vehicle towards the medium.

This project will benefit not only the institution but also the security guards who uses the manual inputting of data in order to monitor the incoming and outgoing vehicles. This system can make their job easily and fast without standing over the heat of the sun.

6. ACKNOWLEDGEMENTS

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