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RESEARCH ARTICLE

e-recognition of Motorbike License Plate using Python and SQLite

Jennifer Bagulaya Abogaa[1]*

1 College of Computer Studies, Eastern Samar State University, Borongan, Eastern Samar, Philippines

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* **Corresponding author**.

jenniferbaguls@gmail.com

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Abstract

Objectives: (1) To solve the problem of inefficiency and inaccuracy of vehicle monitoring; (2) To propose and develop a software that will serve as the initial replacement to a man-to-man motorbike monitoring; (3) Evaluate the components of the system in terms of functionality, efficiency, and accuracy. **Methods:** Waterfall model was used in the system development model. The proposal is a system development and evaluation. Python 3.6 was used in program coding, the Graphical User Interface (GUI) used was Tkinter, the database was SQLite, and the image processing OpenCV was utilized. KNN algorithm was used as the machine learning technique. Using Slovin's formula in finding the sample of respondents with 95% of confidence level and 5 % margin error, resulted 33 respondents. The survey questionnaire is ISO 9126 Quality Software as the bases for software evaluation. Frequency distribution, percentage, and weighted mean were used to interpret the data gathered from the software evaluation metrics. **Findings**: Using the Likert Scale System, the weighted mean of efficiency is 4.25 described as Highly Acceptable, and the weighted mean of accuracy is 4.73 interpreted as Highly Acceptable. The overall mean is 4.49 interpreted as Highly acceptable. The functionality of the software using the percentage and frequency distribution is 100% functional. The proposal is a solution for inefficient and inaccurate of motorbike monitoring. The overall interpretation can be considered as recommendation for further study and additional features for advance version of vehicle license plate recognition. Limitations or non-recognizable pieces found in the license plate can be bearable for future studies recommended. **Novelty:** Initial Step in replacing the man-to-man motorbike License Plate Monitoring. The Author 's version in developing a software that will solve the inefficient and inaccurately monitoring of the status of the congested number of vehicles passing in and out in a certain vicinity, specifically motorbikes.

Keywords: e-recognition; Motorbike; Man-To-Man Monitoring; Replacement; License Plate

1 Introduction

Man-to-man vehicle monitoring is the existing vehicle license plate recognition in the province of Eastern Samar, specifically in Eastern Samar State University (ESSU), the manual monitoring of vehicle makes a problem, due to the ratio of vehicle to worker. Hence, inaccurate and inefficient monitoring is the consequence. As the mobility goes on, the main objective of the study is to develop a software that will serve as the initial replacement to a man-to-man vehicle license plate status recognition, primarily applied to motorbike vehicle, a solution to inefficient and inaccurate motorbike monitoring. Developing a proposed computerized system is an initial solution and the best solution to the problem. *Automatic Number Plate Recognition: A Detailed Survey of Relevant Algorithms,* the rapid urbanization of countries is a great advancement in our modern world. Vehicle plate number recognition plays an important role in traffic control and surveillance systems[(1)]. A key stage in any vehicle plate number recognition system is to first locate the vehicle plate number. People migrate away from rural areas and choose to live in cities mostly. Local governments often fail to recognize the present and potential mobility needs of residents and visitors as traffic rises in these areas.

In our country, the Philippines, 95% replaced the logbook mode to biometrics machine in log-in and log-out recording of any government staff and personnel. Biometrics machine uses image processing in individual identification and database storage. *What is image recognition,* what is the difference is between computer vision and image recognition. Two terms "computer vision" and "image recognition" may have been used interchangeably. Computer vision (CV) is to let a computer imitate human vision and *take action*. For example, CV can be designed to sense a running child on the road and produces a warning signal to the driver. In contrast, image recognition is about the pixel and pattern analysis of an image to recognize the image as a particular object. Computer vision means it can "do something" with recognized images[(2)].

The main concern of any image processing mechanism and transaction is the security. The security is negotiable in accordance to software features and limitations. In this system, limitations are characteristics of License Plate (LP) which are non-recognizable aspects, and they are excluded, such as: (1) the physical aspect of the license plate if it is faded and damaged; (2) do-it-yourself (DIY) plate; and (3) license plate character is overlapped by a text, markers, or stickers. Actually, more image processing mode of transaction are being practice in local and national agencies. Security services office of ESSU with the coordination of LTO are partners in the development of the system. A close-circuit television (CCTV) camera was installed in the ESSU vehicle entrance, and available in capturing, recognizing, and recording the motorbike license plate. Hence, the study is allied concern of two government entity, the Land Transportation Office (LTO), and the Higher Education Institution (HEI), ESSU in particular.

Plate detection and recognition of Iraq License Plate Using KNN algorithm, an automated car license plate recognition system for Iraq vehicle plate number which is developed to control and apply the law enforcement related. It processed the license plate recognition in three stages; preprocessing, license plate localization, license plate recognition. The license plate image is preprocessed through converting the image to grayscale and apply morphological transformation filter to convert the result to binary image. Then, distort the binary image using Gaussian filter, find the contours in the image using OpenCV (Open Source Computer Vision) Library[(3)].

Automated Vehicle License Plate Detection using KNN as a method, KNN identifies the license plate accurately. Preprocessing was the initial step with the aid of median filtering approach. After preprocessing, the system extracts the license plate image of characters. The license numbers were recognized from the extracted license plate with the help of character segmentation approach. Then it was accurately recognized using the machine learning technique which is the KNN classifier[(4)].

Addresses the problem of vehicle plate number localization from simple and complex backgrounds using a novel approach which is based on a modified GrabCut algorithm as an automatic localization technique for identification and extraction of LPs from captured vehicle images[(2)]. License plate detection and extraction is a major stage in VPN recognition[(5)] . Most of the proposed algorithms for LP detection have located the LP from the vehicle image but have issues with sensitivity to brightness, long execution time and low rate of accuracy[(6)] . A comparison of the performance of image enhancement filters such as Sobel, Canny and others was presented. They combined connected component analysis (CCA) to extract the potential LPs. Existing LP localization techniques use information from the vehicle image to aid the identification of the potential LP region[(6)].

In this proposal, the license plate localization, the KNN (K-nearest neighbors) algorithm was used in finding possible characters in the image. Cropping the part of the image with highest candidate license plate, and apply preprocessing, localization, and recognizing all part of the license plate in the cropped image. Python was used in coding the program that makes the system friendly and simple in coding for C++ user, than mathlab, and the database is SQLite, with the integration of these different software makes the system unique and distinct.

As the system developed, evaluation was conducted with these components: (1) functionality; (2) efficiency; (3) accuracy. Adopted on International Standardization Organization (ISO) 9126. Since this system is exclusively used for ESSU motorbike entrants.

The average motorbike entrants in every twenty-four hours are 480-motorbikes in approximate population of ESSU civilians of 4,680. Majority are commuters, other vehicle are non-motorbikes. Why motorbikes? 85% vehicle entering the campus are motorbikes, because of accessibility. Vehicle with high violations are motorbikes, somebody parts of the motorbikes and the scooters are not functioning like signal lights, horns which is dangerous to operators and individuals who pass the same road.

Despite the success of license plate detection (LDP) method in the past decades, only a few methods can effectively detect multi-style license plates (LPs), especially from different countries [5]. Indeed, Philippines as 3rd world country, and the Author is a Motorbike operator, the proposal motivates her to use the waterfall model of the development of the system. The outcome of this proposal such as the efficiency and accuracy in monitoring of motorbike status is a great help to ESSU community, to LTO Eastern Samar Office, and to Motorbike user.

2 Methodology

2.1 Research design

System development and evaluation was used which focused on innovation and strategic learning rather than standard outcomes.

2.2 Location

Study was conducted in ESSU, Main Campus, Borongan City, in the Province of Eastern Samar, Philippines.

2.3 Software Development Model

The software development model used was the Waterfall model. This model is commonly used for small or mid-size projects with clearly defined and unchanging requirements. This software model will help the researchers to manage each procedure during the development process of the proposed system.

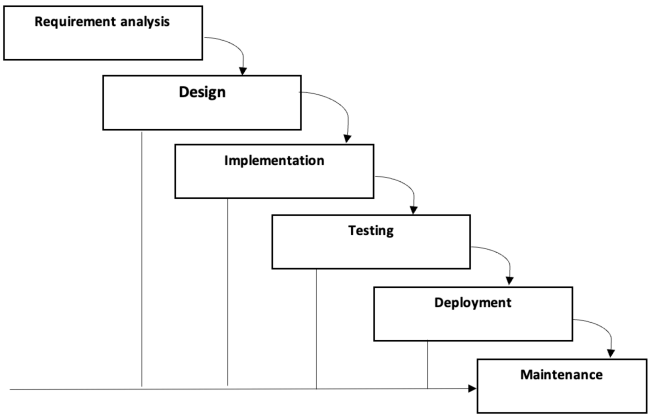

Fig 1. Software Model

Figure 1 has six phases of the software model**:**

1. Requirement Gathering -Includes defining the needs for the development of the proposal and also specifying the limits and scope of the study.

2. Design - This phase includes designing the system features along with its proposed user interface.

3. Implementation -The coding takes place. Defines the implementation of the proposed designs and features to the actual system. This will be done with the use of software/tools selected for the development.

4. Testing - During this stage, an initial version of the system is done and ready to be tested by the end user.

5. Deployment -The system will be distributed to end users for evaluation of the acceptance in terms of its functionality, efficiency, and accuracy.

6. Maintenance - In this phase, it defines the tweaks needed for the errors encountered by the end user for the system to improve its functions.

2.4 System Architecture

Figure 2 shows how the system works. Motorbike license plate number will be extracted based on an input image with the use of K-nearest neighbor (KNN) algorithm. The extracted plates will be compared into the database plates available, and once the extracted image matched the data from the database, it will display the information of the motorbike. If the license plate number is unmatched, a message "UNAUTHORIZED ", meaning no plates available from the database.

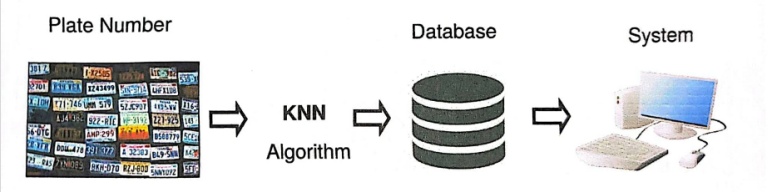

Fig 2. System Architecture

2.5 Software Requirement

Python 3.6 was used in program coding, the Graphical User Interface (GUI) used was Tkinter, the database was SQLite, and in image processing OpenCV was utilized.

Table 1. Hardware Requirement

Windows Edition	**MS Windows10**
Processor	Processor: Intel Celeron CPU: N3450 @ 1.10 GHZ
RAM	4.00GB(3.83 GB usable)
System Type(OS)	64-bit OS x 64-based processor

2.6 Data Gathering and Instrument Used

Using Slovin's formula was used in finding the sample of respondents. The population size applied is 22 security guards from Security Services Office, and 14 faculty members in Information Technology Education ITE department, having the population of 36. Using the margin of error is 5%, and the confidence level is 95%, and the required sample size is 33 respondents.

Unstructured survey questionnaire was used. The ISO 9126 Quality Software used as bases for the software evaluation. It includes the functionality parameter, by identifying both internal and external quality characteristics of software product. It has three representations for defining and identifying the quality of software product; functionality, efficiency, accuracy.

2.7 Statistical treatment

Frequency distribution, percentage, and weighted mean were used to interpret the data gathered from the software evaluation metrics. Likert scale was used as measurement scale for the different software criteria, and weighted mean to determine the actual unified evaluation result.

Likert Scale System

Scale	Interpretation
5	Strongly Agree
4	Agree
3	Neutral
2	Disagree
1	Strongly Disagree

3 Results and Discussion

The Graphical User interface (GUI) of the initial entry is in Figure 4. It shows File menu in entering new data, opening license plate from the database, and closing the program. Figure 4 b. is the screen in searching and deleting the information of a LP,

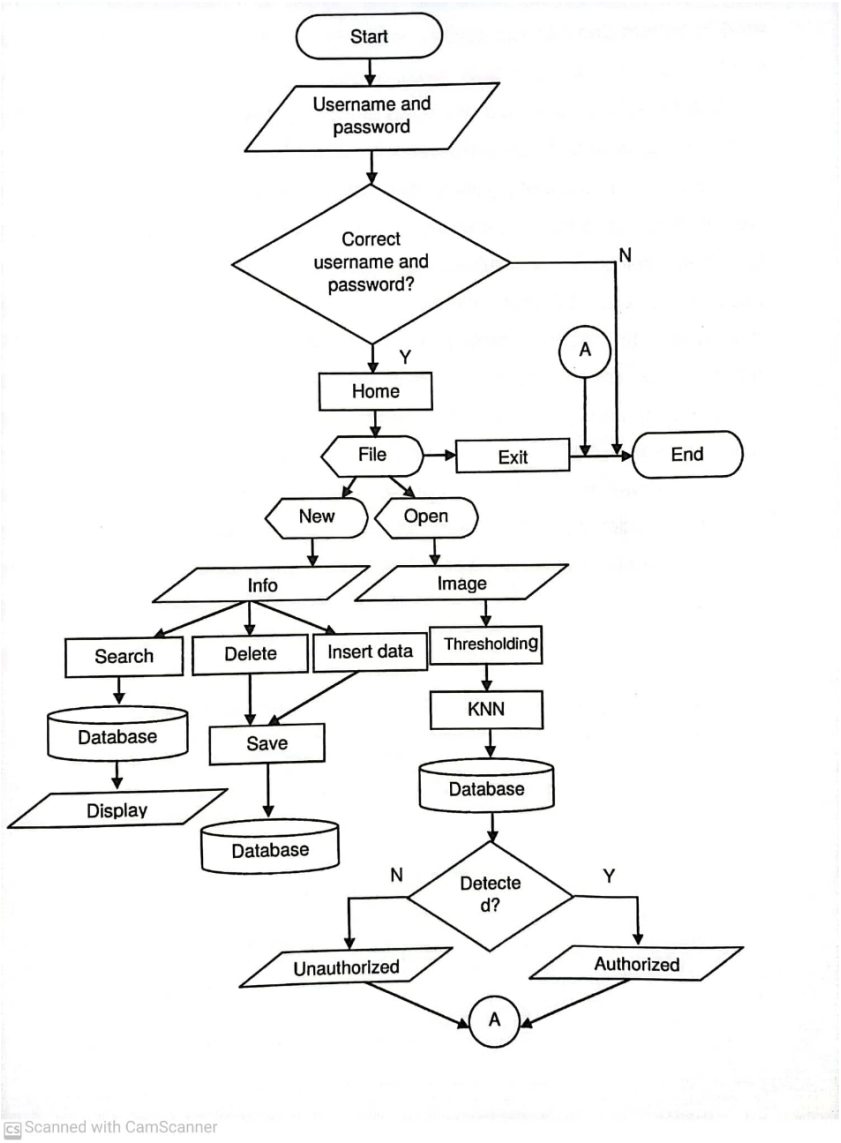

Fig 3. System Flowchart

Table 2. Interpretation Scheme

Range	Interpretation
4.2 – 5.0	Highly Acceptable
3.4 - 4.1	Acceptable
2.6 – 3.3	Neither Acceptable nor Unacceptable
1.8 – 2.5	Unacceptable
1 – 1.7	Highly Unacceptable

adding entry. Figure 5 is the open file menu of LPs, these are the registered LPs to be stored in the database. The registered LP has its GUI in Figure 6, and its information.

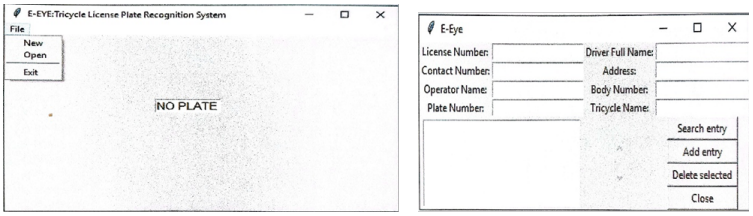

Fig 4. a) GUI of File Menu b) GUI for New data

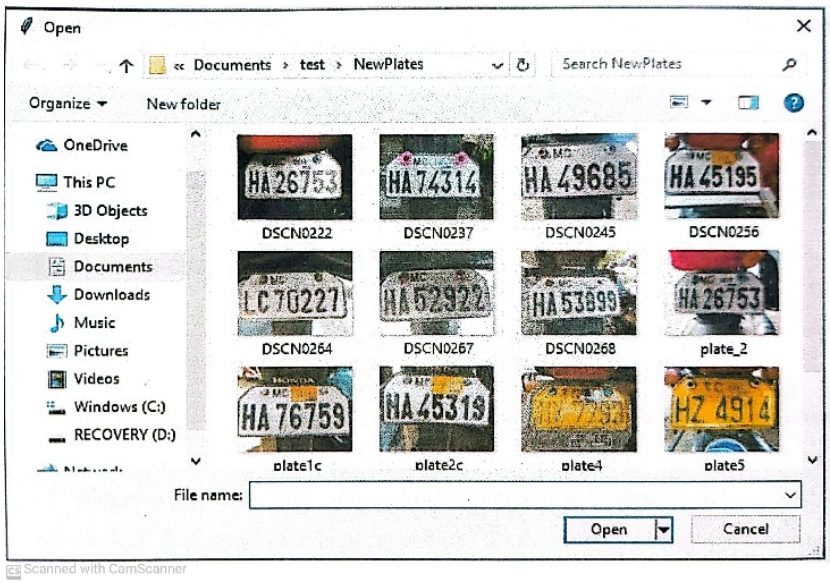

Fig 5. Open File Menu

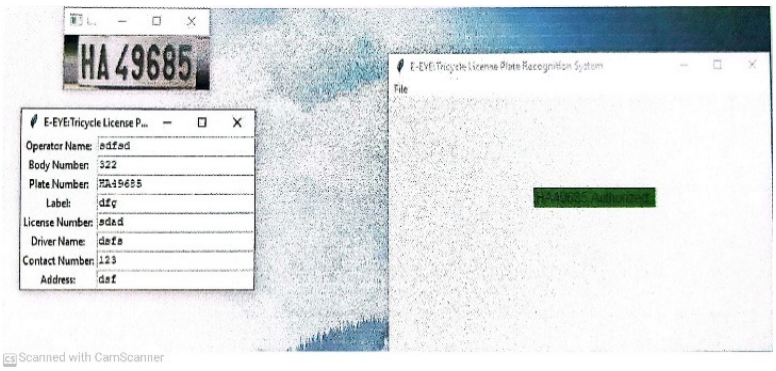

Fig 6. Registered License Plate

Figure 7 searched of LP is mismatch, no available LP from the database, hence a Message will display, "Unauthorized", could be replaced to "Unavailable". Unrecognized information of LP is not available from the database.

The respondent's extent of agreement in terms of functionality of the system is illustrated in Table 3. The functionality of the initial operations of the system is functional in recognizing the LP stored in the database. Buttons, commands, and drop-down

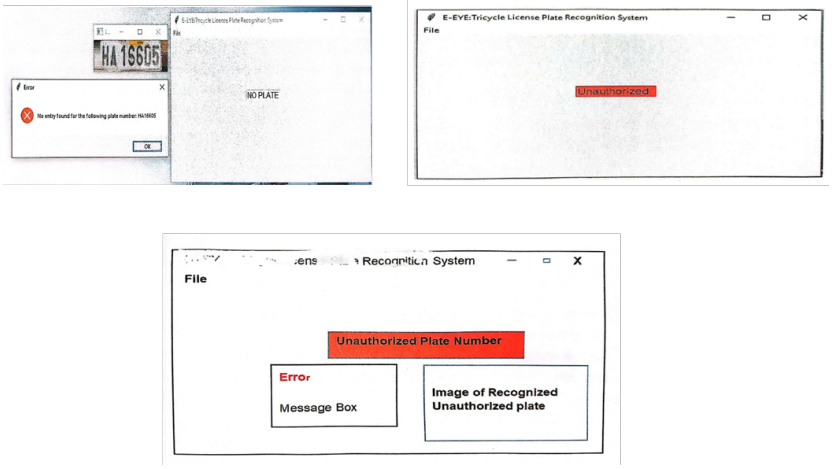

Fig 7. a) Unregistered LP b) Unrecognized LP Figure c) LP information is unavailable

list from the Interface are all functional. The result of displaying the necessary information is efficient, it immediately response and immediately performed. It is acceptable to end user. A good step in replacing the manual operations. The results are evident as an initial solution of the problem. The accuracy in terms of the completeness of the data presented are acceptable. Meaning, the information is complete and correct. If the LP is unregistered the system will clearly provide the message to the user.

Table 3. Functionality, Efficiency, Accuracy

Functionality							Percentage	
							Yes	No
The system can recognize the plate number of the motorbike.							100%	0%
The system can identify registered motorbike.							100%	0%
The system has all functions and capability that was expected to have.							100%	0%
Efficiency	Response						Extent of Agreement	
	5	4	3	2	1	WM	Description	Interpretation
The systems provide appropriate response and processing times and throughput rates when performing its function under stated conditions.	11	16	6	0	0	4.15	Strongly Agree	Acceptable
The system used appropriate amounts and types of resources when the software performs its function under stated condition.	15	15	3	0	0	4.36	Strongly Agree	Highly Acceptable
Accuracy	Response						Extent of Agreement	
	5	4	3	2	1	WM	Description	Interpretation
The system validates input of registered user.	28	5	0	0	0	4.84	Strongly Agree	Acceptance test
The system is precise in its results in terms of tracking documents.	23	8	2	0	0	4.63	Strongly Agree	Highly Acceptable

Table 4. Acceptance test

Software Quality Criteria	**Weighted Mean**	**Interpretation**
Efficiency	4.25	Highly Acceptable
Accuracy	4.73	Highly Acceptable
Overall Mean	4.49	Highly Acceptable

Data presented tune-in the objectives of the study, the status of the motorbike was efficiently recognized which could be a big help to LTO, the huge agency that apprehend those violators, and monitor the possible number of motorbikes officially registered. ESSU Security Services Office can replace the man-to-man monitoring of motorbikes coming-in and going-out of the Campus, less effort and less time consuming.

In comparison of the study made by [(1)] used GrabCut method, while in the study made by [(2)] used you only look once (YOLO) in extracting the image. These techniques are for high intense plate recognition applicable those Developed country, available to all type of vehicle. However, the Author simply developed a software as an initial version or initial solution for inefficiency and inaccurate motorbike monitoring, the proposed study employed OpenCV recognition for a minimum number of vehicles specifically for motorbike license plate, and an initial step for developing high version vehicle plate detection and recognition. Table presented goes to show that possible adaptation and application of advance version of image extraction and capturing can be applied. This study could also be applied to different of type vehicle, not only motorbikes with the recommendation for advance hardware and software capability and its related facilities.

4 Conclusion

The proposal replaced the man-to-man motorbike license plate monitoring. The system is functional, efficient, and accurate in recognizing and showing the status of the motorbike. From the evaluation, the overall acceptance of the software is highly acceptable, hence can be utilized for e-recognition of motorbike LP. Methods applied in software development can be expanded for large number of motorbike or even to include other types of vehicles.

Limitations or non-recognizable pieces found in the license plate are recommended to be detected for further study, features such as: faded and damaged plate, do-it-yourself (DIY) plate, and license plate character is overlapped by a text, markers, or stickers.

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