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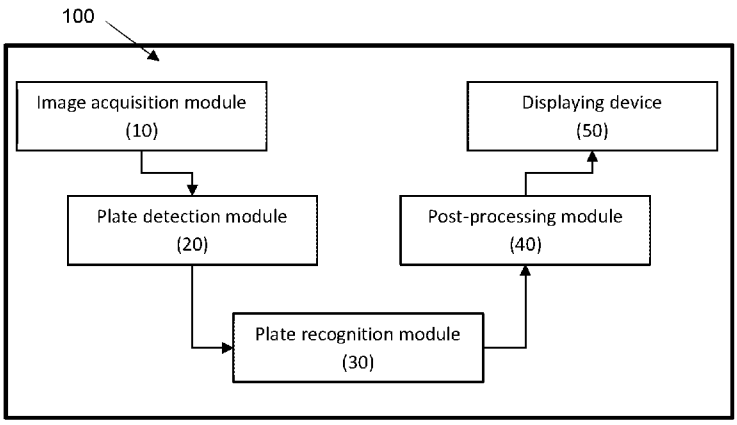

FIG. 1

(57) Abstract: The present invention relates to a system (100) and method for recognising license plate. The system (100) comprising an image acquisition module (10) configured to obtain a plurality of continuous frames, a plate detection module (20) configured to detect the location of the license plate inside the plurality of continuous frames, and a plate recognition module (30) configured to recognise and transform content of the license plate image received from the plate detection module (20) into character text format. The system (100) further comprising a post-processing module (40) configured to analyse a plurality of recognised license plates from the plate recognition module (30) using multi-bag analysis to derive a final recognition result from the plurality of recognised license plates by classifying the plurality of recognised license plates based on the length of the recognised license plates and number of identical numeric and alphabet of the recognised license plates.

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A SYSTEM AND METHOD FOR RECOGNISING LICENSE PLATE

FIELD OF INVENTION

The present invention relates to a system and method for recognising license plate. More particularly, the present invention relates to a system and method for recognising a plurality of license plates by using multi-bag analysis.

BACKGROUND OF THE INVENTION

In an automated license plate recognition system, identity of each vehicle is obtained by automatically detecting location of license plate of the vehicle, segmenting the characters out from the detected license plate and recognising the segmented characters into a readable text format. Therefore the identity of the vehicle is determined from the readable text format of the recognised license plate.

A United States Patent Publication No. 2013/0259314 A1 discloses an example of a method and system for enhancing performance of an automated license plate recognition. The automated license plate recognition system utilises multiple results by capturing multiple images as a vehicle passes through an observation zone and processing each image to obtain plate code results and associated confidence values. Character level information is iteratively processed and optical recognition code is optimally aligned with respect to the multiple images by utilising a string correlation approach to obtain the result.

Although there are many systems and methods for automatically recognising a license plate, most of the systems and methods that compute final recognition result from multiple images have a tendency to display the final recognition result only after the vehicle has left the monitoring zone. This is proven to be a disadvantage as the identity of the vehicle may fall in a black-listed category, whereby an immediate action is needed. Therefore, there is a need for a system and method for automatically recognising a license plate that can improve the processing time of the system for automatically recognising a license plate.

SUMMARY OF INVENTION

The present invention relates to a system (**100**) and method for recognising license plate. The system (**100**) comprising an image acquisition module (**10**)

configured to obtain a plurality of continuous frames, a plate detection module (**20**) configured to detect the location of the license plate inside the plurality of continuous frames, and a plate recognition module (**30**) configured to recognise and transform contents of the plate image received from the plate detection module (**20**) into character text format. The system (**100**) further comprising a post-processing module (**40**) configured to analyse a plurality of recognised license plates from the plate recognition module (**30**) using multi-bag analysis to derive a final recognition result from the plurality of recognised license plates by classifying the plurality of recognised license plates based on the length of the recognised license plates and number of identical numeric and alphabet of the recognised license plates.

Preferably, the post-processing module (**40**) comprising a non-plate filter (**41**) configured to filter noises that resemble license plate from the plurality of recognised license plates based on the number of alphabet and numeric characters a big bag creation and selection sub-module (**42**) configured to group of the plurality of filtered license plates based on identical number of alphabet and numeric characters, wherein the plurality of filtered license plates refer to the recognised license plates that are not discarded by the non-plate filter (**41**), a mini bag creation and selection sub-module (**43**) configured to determine the most related sub-group in the group based on character length of the plurality of filtered license plate, an adaptive frequency updater (**44**) configured to update frequency value for each characters location of the plurality of filtered license plates in each sub-group, and an adaptive recognition analyser (**45**) configured to determine the final recognition result by analysing the updated frequency values in each sub-group.

The method for recognising license plate includes the steps receiving a plurality of continuous frame of a vehicle passing through a monitoring area by an image acquisition module (**10**), detecting location of the license plate inside each frame by a plate detection module (**20**), recognising each character of the license plate of each frame by a plate recognition module (**30**), filtering noises that resemble license plate from a plurality of recognised license plates based on the number of numeric and alphabet characters by a non-plate filter (**41**), grouping a plurality of filtered license plates based on the number of characters exists in the plurality of filtered license plates by a big bag creation and selection sub-module (**42**), wherein the plurality of filtered license plates refer to a plurality of recognised license plates

that are not discarded by the non-plate filter (**41**), determining the most related sub-group for each group based on a character length of the plurality of filtered license plates result by a mini bag creation and selection sub-module (**43**), updating frequency value for each characters location of the plurality of filtered license plates by an adaptive frequency updater (**44**), and determining a final recognition result by an adaptive recognition analyser (**45**).

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIG. 1 illustrates a block diagram of a system (**100**) for recognising license plate according to an embodiment of the present invention.

FIG 2 illustrates a block diagram of sub-modules of a post-processing module (**40**) of the system (**100**) of **FIG. 1**.

FIG. 3 illustrates a flowchart of a method for recognising license plate according to an embodiment of the present invention.

FIG. 4 illustrates a flowchart of sub-steps for grouping filtered license plates of the method of **FIG. 3**.

FIG. 5 illustrates a flowchart of sub-steps for updating a frequency value at each characters location of the filtered license plates of the method of **FIG. 3**.

FIG. 6 illustrates a flowchart of sub-steps for determining a final recognition result of the method of **FIG. 3**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well known functions or constructions are not described in detail since they would obscure the description with unnecessary detail.

Reference is initially made to **FIG. 1** which illustrates a block diagram of a system (**100**) for recognising license plate according to an embodiment of the present invention. The system (**100**) comprises an image acquisition module (**10**), a plate detection module (**20**), a plate recognition module (**30**), a post-processing module (**40**), and a displaying device (**50**). Generally, the system (**100**) analyses multiple images that are captured from a moving vehicle which enters a monitoring zone. Final recognition result is obtained by analysing a plurality of recognised license plates from multiple frames using a multi-bag analysis, wherein the multi-bag analysis is a method of classifying the recognised license plates from multiple frames based on the length of the recognised license plates and number of identical numeric and alphabet characters of the recognised license plates.

The image acquisition module (**10**) is configured to obtain a plurality of continuous frames from a video capturing device.

The plate detection module (**20**) is connected to the image acquisition module (**10**) and the plate recognition module (**30**). The frames obtained by the image acquisition module (**10**) are processed by the plate detection module (**20**) to detect the location of the license plate inside the frames. The detected license plates are sent to the plate recognition module (**30**).

The plate recognition module (**30**) is connected to the plate detection module (**20**) and the post-processing module (**40**). The plate recognition module (**30**) is configured to recognise contents of the license plate image received from the plate detection module (**20**), transform the contents of the license plate image into character text format and send to the post-processing module (**40**) for final recognition. The character text format includes both alphabet and numeric.

The post-processing module (**40**) is connected to the plate recognition module (**30**) and the displaying device (**50**). The post-processing module (**40**) is configured to analyse the recognised license plates of every frames from the plate recognition module (**30**) using multi-bag analysis to derive a final recognition result from the recognised license plates of every frames of each vehicle. The final recognition result is sent to the displaying device (**50**) to be displayed in real time. As

shown in **FIG. 2** which illustrates a block diagram of sub-modules of the post-processing module (**40**) of the system (**100**), the post-processing module (**40**) comprising a non-plate filter (**41**), a big bag creation and selection sub-module (**42**), a mini bag creation and selection sub-module (**43**), an adaptive frequency updater (**44**) and an adaptive recognition analyser (**45**).

The non-plate filter (**41**) is configured to filter noises that resemble license plate from the recognised license plates based on the number of alphabet and numeric characters. The non-plate filter (**41**) receives the recognised license plates of every frames from the plate recognition module (**30**) and filters out the recognised license plate that has low possibility of a valid plate image. The non-plate filter (**41**) sends the filtered license plates to the big bag creation and selection sub-module (**42**).

The big bag creation and selection sub-module (**42**) is configured to group the filtered license plates based on an identical number of alphabet and numeric characters. The mini bag creation and selection sub-module (**43**) is configured to determine the most related sub-group of each group, wherein sub-groups are subdivisions of the group based on character length. The character length is the total number of alphabet and numeric characters of the filtered license plates. The adaptive frequency updater (**44**) is configured to update frequency value for each characters location of the filtered license plates in each sub-group, wherein the characters location is a position of either an alphabet or a numeric character in the filtered license plates. Frequency value is total occurrence of a similar character being displayed at the same characters location. The adaptive recognition analyser (**45**) is configured to determine the final recognition result by analysing the updated frequency values in each sub-group.

Referring back to **FIG. 1**, the displaying device (**50**) which is connected to the post-analysing module (**40**) is configured to display the final recognition result of the license plate of the vehicle.

Reference is now made to **FIG. 3** which illustrates a flowchart of a method for recognising license plate according to an embodiment of the present invention. Initially, the image acquisition module (**10**) receives a plurality of continuous frames

of a vehicle passing through a monitoring area from a video acquiring device as in step **1000**. The frames are then sent to the plate detection module (**20**). The plate detection module (**20**) then processes the frames and detects the location of the license plate inside each frame as in step **2000**.

The plate recognition module (**30**) then recognises each character of the license plate in each frame as in step **3000**. The characters include alphabets and numerics. The plate recognition module (**30**) sends the recognised license plates of every frames to the non-plate filter (**41**).

Thereon, the non-plate filter (**41**) filters noises that resemble license plate from the recognised license plates as in step **4000**. The noises are the recognised license plate that has a low probability of being a valid license plate. The non-plate filter (**41**) filters the noises based on the number of numeric and alphabet characters. If the recognised license plate has the number of numeric and alphabet characters less than the minimum value of allowed characters or more than the maximum value of allowed characters, the recognised license plate is discarded by the non-plate filter (**41**) as noise. The recognised license plates that are not discarded by the non-plate filter (**41**) are known as the filtered license plates. The filtered license plates are then sent to the big bag creation and selection sub-module (**42**) for the next step.

The big bag creation and selection sub-module (**42**) receives the filtered license plates from the non-plate filter (**41**) and groups the filtered license plates as in step **5000**. The filtered license plates are grouped based on the number of numeric and alphabet characters exists in the filtered license plates. The sub-steps for grouping the filtered license plates are further explained in relation to **FIG. 4**.

Thereon, the mini bag creation and selection sub-module (**43**) determines the most related sub-group for each group based on the character length of the filtered license plates as in step **6000**. Sub-groups are subdivisions of the group based on character length, wherein the character length is the total number of alphabet and numeric characters of the filtered license plates. The mini bag creation and selection sub-module (**43**) computes the character length of every filtered license plates and selects the sub-group that has a similar character length. If none of the sub-groups in

the group has a similar character length, the mini bag creation and selection sub-module (**42**) creates a new sub-group for the filtered license plates.

The adaptive frequency updater (**44**) then updates frequency value for each characters location of the filtered license plates for each sub-group as in step **7000**, wherein the characters location is a position of either an alphabet or a numeric character in the filtered license plates. Frequency value is total occurrence of a similar character being displayed for in the same characters location. The sub-steps for updating the frequency value at each characters location of the filtered license plates for each sub-group are further explained in relation to **FIG. 5**.

The adaptive recognition analyser (**45**) determines the final recognition result as in step **8000**. The adaptive recognition analyser (**45**) computes a voting value for each sub-group to determine whether the sub-group contains the final recognition result that fulfill conditions for publishing the final recognition result. The conditions for publishing the final recognition result are further explained in relation to **FIG. 6**. The voting value represents the total characters location of the filtered license plates in the sub-group where the frequency value at the characters location had exceeded a certain threshold value. The sub-steps for determining the final recognition result are further explained in relation to **FIG. 6**. Finally, the displaying device (**50**) displays the final recognition result as in step **9000**.

FIG. 4 illustrates a flowchart of sub-steps for grouping the filtered license plates of the steps **5000** of the method of **FIG. 3**. Initially, the big bag creation and selection sub-module (**41**) computes the character length of each filtered license plate as in step **5100**. The big bag creation and selection sub-module (**41**) then computes identical numeric and alphabet characters of each filtered license plate as in step **5200**. The big bag creation and selection sub-module (**41**) removes the identical numeric and alphabet characters from the character length to obtain the number of characters exists in each filtered license plate as in step **5250**.

Thereon, the big bag creation and selection sub-module (**41**) selects a group that best matches each filtered license plate as in step **5300**. The group is selected based on the number of characters exists in the filtered license plate. If the number of

characters exists in the filtered license plate of the group is the same as the number of characters exists in the filtered license plate, the group is selected.

The big bag creation and selection sub-module (**41**) determines whether an existing group is selected or not as in step **5350**. If the existing group is selected, the big bag creation and selection sub-module (**41**) directly updates properties in the group such as the character length, number of identical numeric, number of identical alphabet and number of characters exists in the filtered license plate as in step **5500**. Each group has the properties to assist the process of matching the filtered license plates with the group.

On the other hand, if none of the existing groups is selected, the big bag creation and selection (**41**) creates a new group for the filtered license plate that is not grouped result as in step **5400** and updates the properties in the group as in step **5500**.

FIG. 5 illustrates a flowchart of sub-steps for updating the frequency value for each characters location of the filtered license plates for each sub-group of step **7000** of the method of **FIG. 3**. After the most suitable sub-group is selected by the mini bag creation and selection sub-module (**43**) as in step **6000**, the adaptive frequency updater (**44**) selects a matched character buffer at characters location of the filtered license plates as in step **7100**. The matched character buffer is a character that previously matched with the filtered license plates in the particular sub-group.

The adaptive frequency updater (**44**) then determines whether all characters of the filtered license plates match with the matched character buffer at each characters location as in decision **7150**. If there is at least one character that does not match with the matched character buffer, the adaptive frequency updater (**44**) creates a new matched character buffer at the mismatched characters location of the filtered license plates as in step **7200**. The adaptive frequency updater (**44**) increases a frequency value of the matched character buffer at each characters location of the filtered license plates as in step **7300**.

On the other hand, if all the characters of the filtered license plates match with the matched character at each characters location as in decision **7150**, the adaptive

frequency updater (**44**) directly increases the frequency value of the matched character buffer at each characters location of the filtered license plates as in step **7300**.

Thereon, the adaptive frequency updater (**44**) stores the value of the highest frequency value and its corresponding matched character buffer for each characters location as in step **7400**.

FIG. 6 illustrates a flowchart of sub-steps for determining the final recognition result of the step **8000** of the method of **FIG. 3**. The adaptive recognition analyser (**45**) computes the voting value for each sub-group to determine whether the sub-group contains final recognition result that fulfill the condition for publishing the final recognition result. Initially, the adaptive recognition analyser (**45**) determines whether the highest frequency value of the filtered license plates in each sub-group exceeds a predefined value as in decision **8050**, wherein the predefined value refers to a confidence value of a consistency for a similar character appears on the same characters location.

If the highest frequency value of the filtered license plates in the sub-group does not exceed the confidence value of a consistency for a similar character appears on the same characters location, the adaptive recognition analyser (**45**) rejects the filtered license plates as in step **8800** and no filtered license plates in the sub-group will be published as the final result.

On the other hand, if the highest frequency value of the filtered license plates in the sub-group exceeds the confidence value of a consistency for a similar character appears on the same characters location, the adaptive recognition analyser (**45**) increases the voting value as in step **8100**. Thereon, the adaptive recognition analyser (**45**) determines whether the voting value is equal to the character length of the filtered license plates as in decision **8150**.

If the voting value is equal to the character length of the filtered license plates, the adaptive recognition analyser (**45**) increases a delay timer as in step **8200**, wherein the delay timer is a timer for a sub-group with voting value that is more than the predefined value. Thereon, the adaptive recognition analyser (**45**) determines

whether the delay timer is greater than a threshold value of delay timer as in decision **8250**. If the delay timer is less than the threshold value of delay timer as in decision **8200**, the adaptive recognition analyser (**45**) rejects the filtered license plates as in step **8800** and no filtered license plates in the sub-group will be published as the final result. The system (**100**) waits for a later recognition which may be more accurate, wherein the later recognition result is the filtered license plates that are obtained from frames after the frames of the filtered license plates.

On the other hand, if the delay timer is greater than the threshold value of delay timer, the adaptive recognition analyser (**45**) published the characters with the highest frequency as the final recognition result as in step **8300**.

If the voting value is not equal to the character length as in decision **8150**, the adaptive recognition analyser (**45**) determines whether the voting value is greater than the minimum number of character as in decision **8400**. If the voting value is less than or equals to the minimum number of character, the adaptive recognition analyser (**45**) rejects the filtered license plates as in step **8800** because the filtered license plates does not meet the confidence value of the system (**100**) and may be noises that were not filtered by the non-plate filter (**41**). Additionally, no filtered license plates in the sub-group will be published as the final result.

Otherwise, if the voting value is greater than the minimum number of character as in decision **8400**, the adaptive recognition analyser (**45**) increases a silence timer as in step **8500**. The silence timer is a timer for a sub-group that does not have voting value more than a predefined value but has more than a minimum voting value to ensure there is a final recognition result to be published.

The adaptive recognition analyser (**45**) then determines whether the silence timer is greater than a threshold value of silence timer as in decision **8600**. If the silence timer is less than the threshold value of silence timer, the adaptive recognition analyser (**45**) rejects the filtered license plates as in step **8800** and no filtered license plates in the sub-group will be published as the final result. The system (**100**) waits for the later recognition result.

If the silence timer is greater than the threshold value of silence timer, the adaptive recognition analyser (**45**) determines whether the number of filtered license plates in the sub-group is greater than a minimum number of filtered license plates in the sub-group as in decision **8700**. If the number of filtered license plates in the sub-group is greater than a minimum number of filtered license plates in the sub-group, the adaptive recognition analyser (**45**) published the characters with the highest frequency as the final recognition result as in step **8300**.

On the other hand, if the silence timer is less than or equals to the threshold value of the silence timer as in decision **8700**, the adaptive recognition analyser (**45**) rejects the filtered license plates as in step **8800** and no filtered license plates in the sub-group will be published as the final result.

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specifications are words of description rather than limitation and various changes may be made without departing from the scope of the invention.

CLAIMS

1. A system (**100**) for recognising license plate comprising:
   a) an image acquisition module (**10**) configured to obtain a plurality of continuous frames;
   b) a plate detection module (**20**) configured to detect the location of the license plate image inside the plurality of continuous frames; and
   c) a plate recognition module (**30**) configured to recognise and transform contents of the license plate image received from the plate detection module (**20**) into character text format;

   characterised in that the system (**100**) further comprising:
   d) a post-processing module (**40**) configured to analyse a plurality of recognised license plates from the plate recognition module (**30**) using multi-bag analysis to derive a final recognition result from the plurality of recognised license plates by classifying the plurality of recognised license plates based on the length of the recognised license plates and number of identical numeric and alphabet of the recognised license plates.

2. The system (**100**) as claimed in claim **1**, wherein the post-processing module (**40**) comprising:
   a) a non-plate filter (**41**) configured to filter noises that resemble license plate from the plurality of recognised licence plates based on the number of alphabet and numeric characters;
   b) a big bag creation and selection sub-module (**42**) configured to group a plurality of filtered license plates based on identical number of alphabet and numeric characters, wherein the plurality of filtered license plates refers to the recognised license plates that are not discarded by the non-plate filter (**41**);
   c) a mini bag creation and selection sub-module (**43**) configured to determine the most related sub-group in the group based on character length of the plurality of filtered license plate;
   d) an adaptive frequency updater (**44**) configured to update frequency value for each characters location of the plurality of filtered license plates in each sub-group; and

e) an adaptive recognition analyser (**45**) configured to determine the final recognition result by analysing the updated frequency values in each sub-group.

3. The system (**100**) as claimed in claim **1**, wherein the system (**100**) further comprising a displaying device (**50**) configured to display the final recognition result of the license plate of the vehicle.

4. A method for recognising license plate is characterised by the steps of:

a) receiving a plurality of continuous frame of a vehicle passing through a monitoring area by an image acquisition module (**10**);

b) detecting location of the license plate inside each frame by a plate detection module (**20**);

c) recognising each character of the license plate of each frame by a plate recognition module (**30**);

d) filtering noises that resemble license plate from a plurality of recognised license plates based on the number of numeric and alphabet characters by a non-plate filter (**41**);

e) grouping a plurality of filtered license plates based on the number of characters exists in the plurality of filtered license plates by a big bag creation and selection sub-module (**42**), wherein the plurality of filtered license plates is the plurality of recognised license plates that are not discarded by the non-plate filter (**41**);

f) determining the most related sub-group for each group based on a character length of the plurality of filtered license plates result by a mini bag creation and selection sub-module (**43**);

g) updating frequency value for each characters location of the plurality of filtered license plates by an adaptive frequency updater (**44**); and

h) determining a final recognition result by an adaptive recognition analyser (**45**).

5. The method as claimed in claim **4**, wherein grouping the plurality of filtered license plates based on the number of characters exists in the plurality of filtered license plates includes the steps of:

a) computing character length of each filtered license plate;

b) computing identical numeric and alphabet characters of each filtered license plate;
c) obtaining the number of characters exists in each filtered license plate;
d) selecting an existing group that best matches each filtered license plate based on the number of characters exists in the filtered license plate;
e) determining whether an existing group is selected or not; and
f) creating a new group for the filtered license plate if none of the existing groups is selected.

6. The method as claimed in claim **4**, wherein determining the most related sub-group for each group based on the character length of the plurality of filtered license plates by the mini bag creation and selection sub-module (**43**) includes the steps of:
a) computing character length of each filtered license plate;
b) selecting an existing sub-group that has similar character length as the filtered license plate;
c) determining whether an existing sub-group is selected or not; and
d) creating a new group for the filtered license plate if none of the existing sub-groups is selected.

7. The method as claimed in claim **4**, wherein updating frequency value for each characters location of the plurality of filtered license plates includes the steps of:
a) selecting a matched character buffer at each characters location of the plurality of filtered license plates;
b) determining whether all characters of the plurality of filtered license plates match with the matched character buffer at each characters location;
c) creating a new matched character buffer at the mismatched characters location of the plurality of filtered license plates if there is at least one character that does not match the matched character buffer; and
d) increasing a frequency value of the matched character buffer at each characters location of the recognition.

8. The method as claimed in claim **7**, wherein if all the characters of the plurality of filtered license plates match with the matched character buffer of each character location, the step includes increasing a frequency value of the matched character buffer at each characters location of the plurality of filtered license plates.

9. The method as claimed in claim **4**, wherein the step of determining the final recognition result by the adaptive recognition analyser (**45**) includes the sub-steps of:

a) determining whether the highest frequency value of the plurality of filtered license plates in each sub-group exceeds a confidence value of a consistency for a similar character appears on the same characters location;

b) increasing a voting value if the highest frequency value of the plurality of filtered license plates in the sub-group exceeds the confidence value of a consistency for a similar character appears on the same characters location;

c) determining whether the voting value is equal to a character length of the plurality of filtered license plates;

d) increasing a delay timer if the voting value is equal to the character length of the plurality of filtered license plates;

e) determining whether the delay timer is greater than a threshold value of delay timer; and

f) publishing the characters with the highest frequency as the final recognition result if the delay timer is greater than the threshold value of delay timer.

10. The method as claimed in claim **9**, wherein the step includes rejecting the plurality of filtered license plates, if the highest frequency value of the plurality of filtered license plates in the sub-group does not exceed the confidence value of how consistent a similar character appears on the same characters location.

11. The method as claimed in claim **9**, wherein if the voting value is not equal to the character length, the steps include:
    a) determining whether the voting value is greater than the minimum number of character;
    b) increasing a silence timer if the voting value is greater than the minimum number of character;
    c) determines whether the silence timer is greater than a threshold value of silence timer;
    d) determining whether the number of filtered license plates in the sub-group is greater than a minimum number of filtered license plates in the sub-group if the silence timer is greater than the threshold value of silence timer; and
    e) publishing the characters with the highest frequency as the final recognition result if the number of filtered license plates in the sub-group is greater than a minimum number of filtered license plates in the sub-group.

12. The method as claimed in claim **11**, wherein the plurality of filtered license plates is rejected if:
    a) the voting value is less than or equals to the minimum number of character;
    b) the silence timer is less than or equals to the threshold value of silence timer; and
    c) the number of filtered license plates in the sub-group is less than or equals to the minimum number of filtered license plates result in the sub-group.

13. The method as claimed in claim **9**, wherein the step includes rejecting the plurality of filtered license plates, if the delay timer is less than or equals to the threshold value of delay timer.

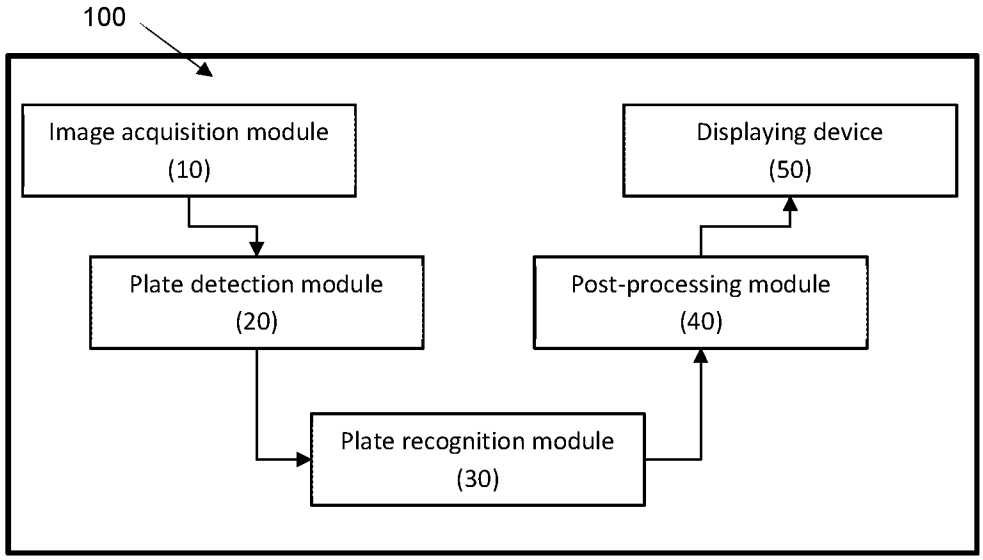
100
Image acquisition module
(10)
Displaying device
(50)
Plate detection module
(20)
Post-processing module
(40)
Plate recognition module
(30)

FIG. 1

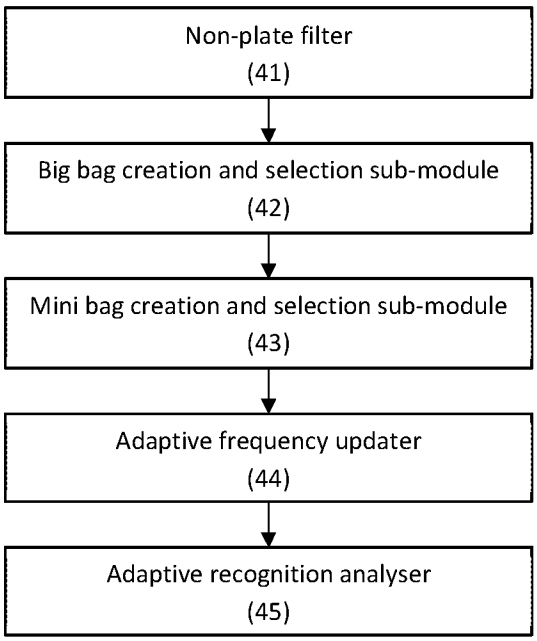
Non-plate filter
(41)
Big bag creation and selection sub-module
(42)
Mini bag creation and selection sub-module
(43)
Adaptive frequency updater
(44)
Adaptive recognition analyser
(45)

FIG. 2

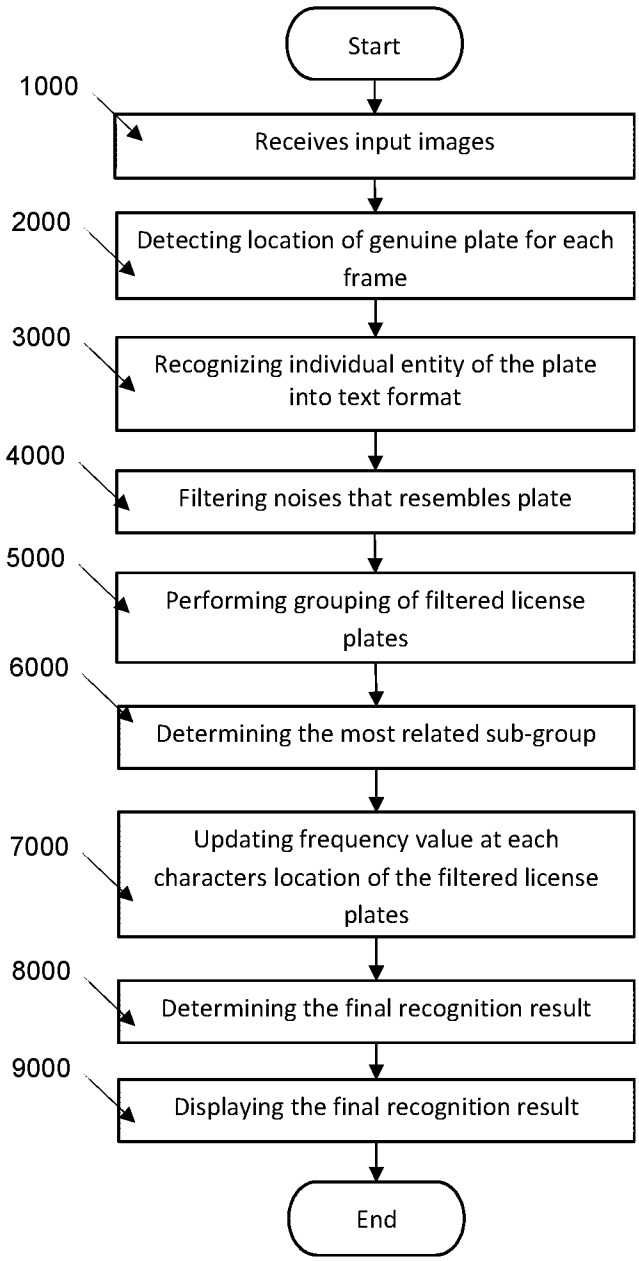
Start
1000
Receives input images
2000
Detecting location of genuine plate for each frame
3000
Recognizing individual entity of the plate into text format
4000
Filtering noises that resembles plate
5000
Performing grouping of filtered license plates
6000
Determining the most related sub-group
7000
Updating frequency value at each characters location of the filtered license plates
8000
Determining the final recognition result
9000
Displaying the final recognition result
End

FIG. 3

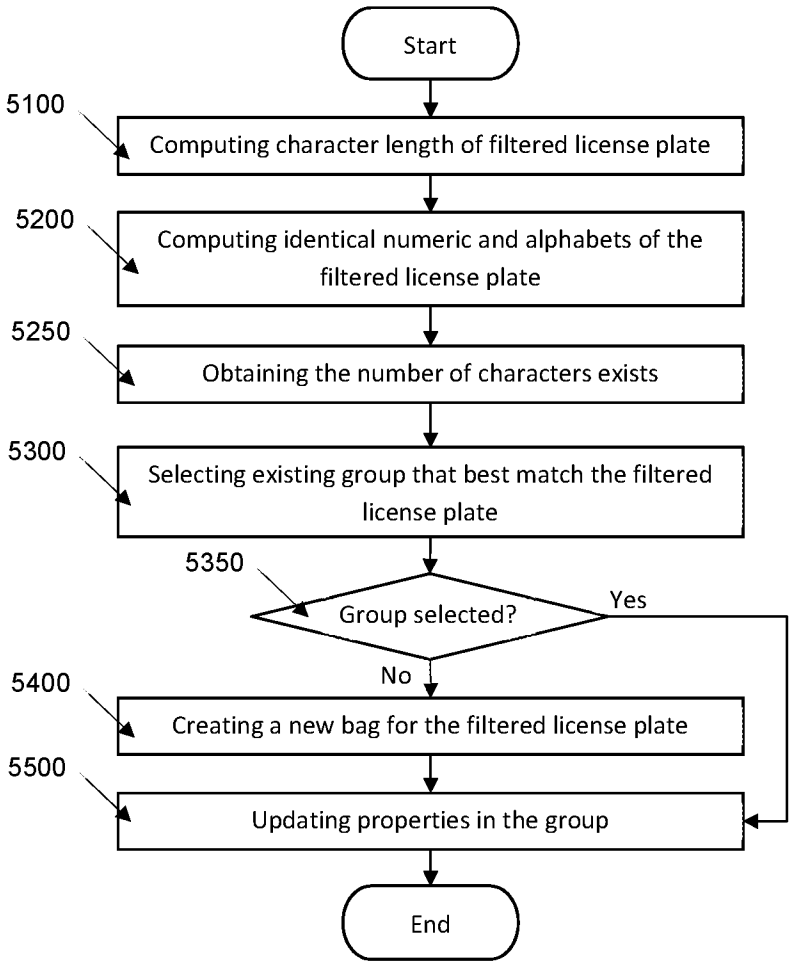
Start
5100
Computing character length of filtered license plate
5200
Computing identical numeric and alphabets of the filtered license plate
5250
Obtaining the number of characters exists
5300
Selecting existing group that best match the filtered license plate
5350
Group selected?
Yes
No
5400
Creating a new bag for the filtered license plate
5500
Updating properties in the group
End

FIG. 4

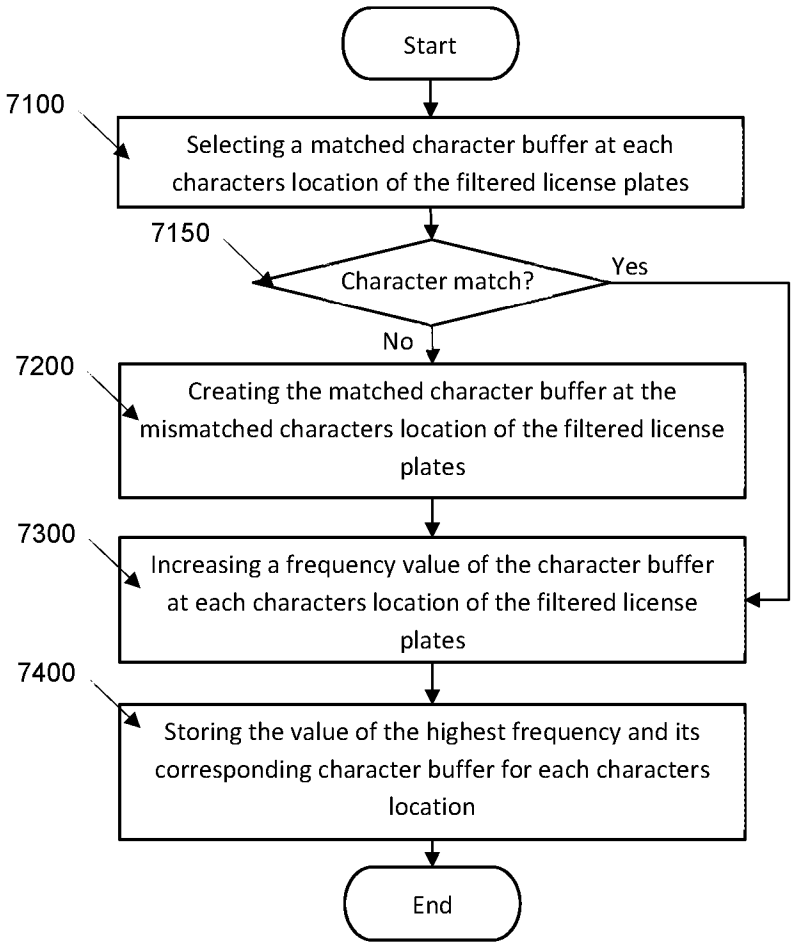
Start
7100
Selecting a matched character buffer at each characters location of the filtered license plates
7150
Character match?
Yes
No
7200
Creating the matched character buffer at the mismatched characters location of the filtered license plates
7300
Increasing a frequency value of the character buffer at each characters location of the filtered license plates
7400
Storing the value of the highest frequency and its corresponding character buffer for each characters location
End

FIG. 5

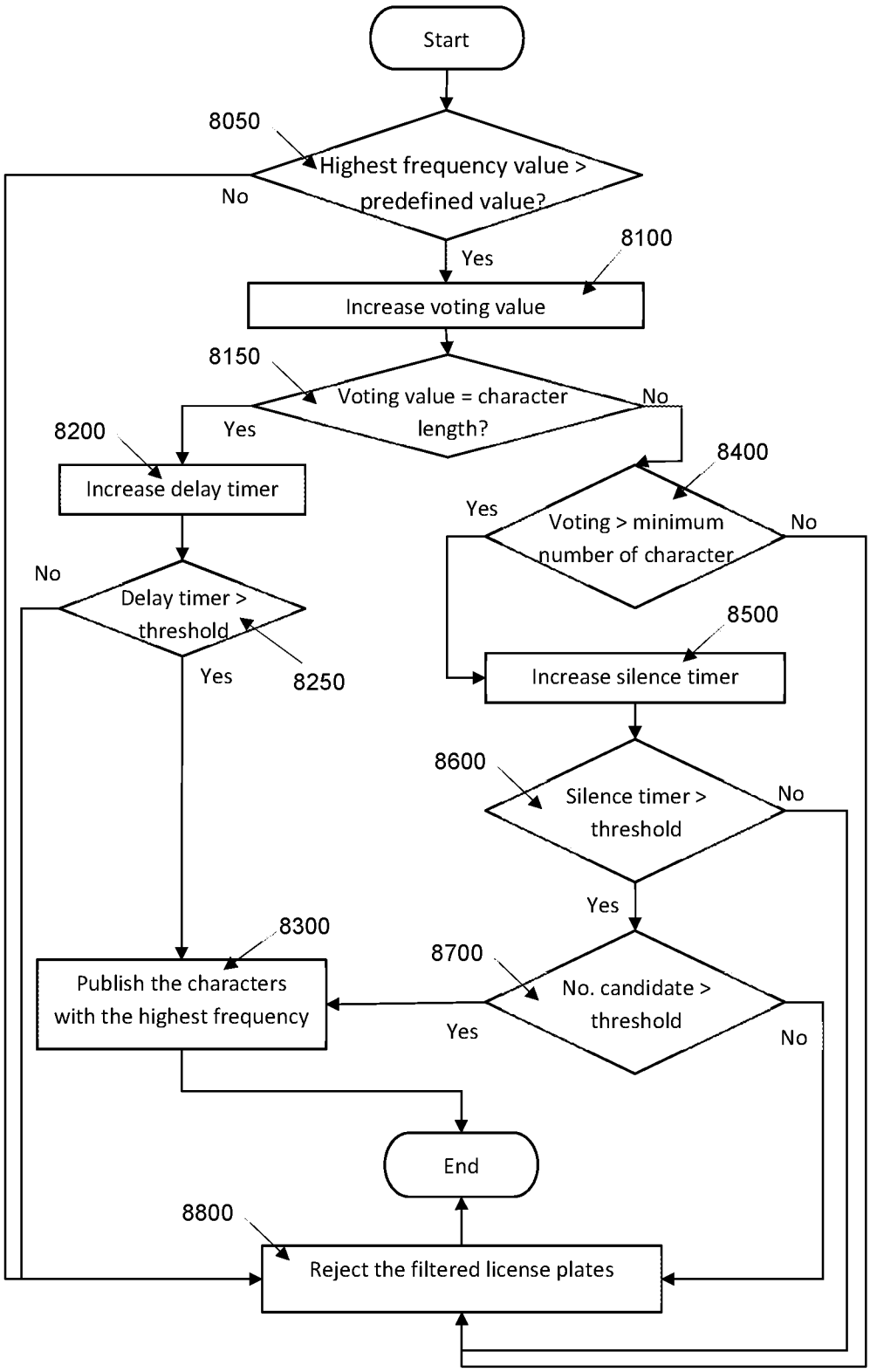
Start
8050
Highest frequency value > predefined value?
No
Yes
8100
Increase voting value
8150
Voting value = character length?
No
Yes
8200
Increase delay timer
8400
Yes
Voting > minimum number of character
No
No
Delay timer > threshold
8250
Yes
8500
Increase silence timer
8600
Silence timer > threshold
No
Yes
8300
8700
Publish the characters with the highest frequency
No. candidate > threshold
Yes
No
End
8800
Reject the filtered license plates

FIG. 6