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Genuine Automobile Parts Scanner Using QR-Code

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Abstract — *Now a days Duplication has increased in all fields .This has also affected the Automobile Industry too .Our Mobile Application is our step taken against this Duplication .Now a days Automation has brought revolution in all Industry including out I.T industry too.Our Mobile Application would serve efficiently to all its users by making their task easy to communicate with their Automobile Makers and the Automobile Company Authorized Service Station. Through our Mobile Application the end-user can easily manage to "Get Appointments for their Vehicle service" ,"Check for Genuine Parts Installed in his/her Vehicle " and many more. Whenever the service center will install a new Part in User's vehicle, at the time of Billing a Barcode/ QR code will be generated on the bill .By Using the our Mobile Application the User would be able to Scan this Barcode/QR code and cross check with the database of Automobile maker whether the installed Part in his/her Vehicle is Genuine or not as the Product id number will also be detected during the scanning of the Barcode/QR code generated .Using our Application the user can also track his/her service. Our Android Application will help to make better Future without any Duplication Of parts in Automobile industry that hinders the growth of our Automobile Industry.*

Keywords- *QR-Code , Genuinity , Duplication , Service Tracking , Appointments .*

I. INTRODUCTION

The main aim of Genuine Automobile Parts Scanner is to check whether the part installed in car is genuine or not by scanning the Qrcode on the bill .It also provide integrated and fully automated Android application to Car Owner so all the task will be in well managed and handled in proper way. Now a day's, in the era of the Internet it is not worth full to perform such task manually which may evolve in some critical issue like loss of information etc. Therefore the main purpose our system is to provide fully centralized and automated application through which car owner can perform various tasks like take appointment for car service,track his car service,check whether the part installed in car is genuine or not.

The Genuine Automobile Parts Scanner is also made for the car service provider. Car Service provider can make use of it for providing information about Clients details, Service details,Package details, Company details, Payment details etc. It can be used in service centers & modification can be easily done according to requirement.

1.1. QR Code:

(**Q**uick **R**esponse code) A two-dimensional barcode widely used for many purposes. All QR codes have a square shape and include three square outlines in the bottom-left, top-left, and top-right corners. Orientation of the code is defined through these square outlines. Format, version information is contained in the dots of the QR code. The QR code can store up to 4,296 alphanumeric or 7,089 numeric characters, and if a high level of error correction is used, up to 30% of the image can be smudged and still be recognized.

1.1.1. Understanding of QR Code:

Bar code scanner is used to read the barcode known as QR code.Smart devices use this scanners as in the form of apps. All website URLs, data, and text are encoded in the form of information in these codes. In japan these codes were originated which were used by toyota for tracking of car's parts. In now a days technology, QR code scanner is used in each and every smart phones for better benefits. All business and multi-national companies uses QR codes to reach out to their client base.

1.1.2. Architecture of QR Code:

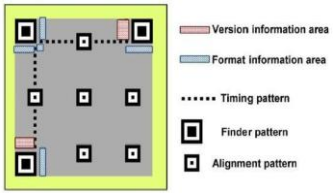

Figure 1 : Structure of QR Code

QR generator software is used for the translation of data to QR code, many are available for free. Data entered by the user is converted into electrically secret code form. Peoples personal information, company's logo or any authentication information is stored.

II. EXISTING SYSTEM

The existing system is very simple and does not have many features. The present system only allows customer to simply take the appointment for the servicing of the car. And generates the hard copy of the invoice. Which is given to the customers when they take the delivery of their serviced car. The invoice contains the parts id which are installed in the cars and the invoice amount that is to be paid. The present system has facility to pay the invoice either by cash or by swiping the credit or debit cards.

III. FLOW OF EXISTING SYSTEM

In the existing system the customer has to sign in into the application using the VIN number that is vehicle identity number along with the username and password of customer. Then the customer can take the appointment for servicing the car. The request goes to the server system and the appointment is given. At the end of service the customer gets the car along with the invoice generated by the server system. The customer can simply have a look to the invoice and simply logout of the system.

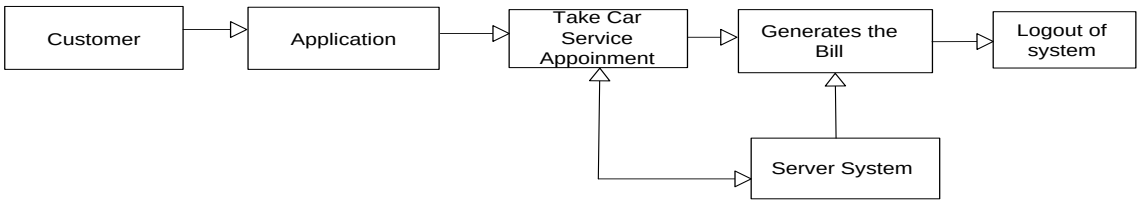

Figure 2 : Flow of Existing System

IV. LIMITATIONS OF EXISTING SYSTEM

In present many Automobile brands have their own car servicing applications . But they does not have any feature of checking genuinity of parts installed in customers car during servicing of the car . So the customer cannot check whether the parts installed in their cars are genuine or duplicate or previously used part . In existing applications the customer each customer can only register a single car uniquely . But it may be possible that the customer has more than one car of same or different brands at same time. So customer has to register on same or more different applications of car servicing depending upon the car brand .The current applications does not provide real time tracking of car service The present Applications does not provide any information about the past service records of the cars .It also does not provide notifications for the future car services The user interface of current application is not user friendly and easy to use.

V. PROPOSED SYSTEM

To overcome the limitations of the existing system we designed new system with better user interface and adding more functionalities to the new system. The new system comprises of many new functionalities like taking the appointment for the car service, tracking the service of the car, checking for the genuinity of parts installed in car during the service, getting notifications about the service and installing the new parts, advertisements for free camps and attractive service offers, road side assistance , access to past car service records and may more.

VI. FLOW OF PROPOSED SYSTEM

The customers has to sign in into our system if they have already signed up into the system by filling the details. Then the customers can get the appointment for their car service . Once the customer gets the appointment they can track their car service as after they give their car into service center. The customer will get the notification for changing of car parts if required when the customer will approve the change of parts further process will be carried out. When the service of car is completed the customer will get the notification of completion of service along with the invoice. When the customers gets the car along with the hard copy of invoice the invoice contains the QR code generated by our server system. Customers have to scan this QR code with the help of our application. As the customers scan the QR code the application will automatically get all the details about the Parts installed into the car in service along with their Part id and on other side the car id would be updated in database of parts on our server showing which part is installed in which car . And on single click of customer the parts id showing in the invoice would be validated with the parts id in database

of parts present on the server. By doing this the customer will come to know whether the part installed in car is duplicate or used one. And if the customers founds that the part is duplicate they can complaint about this to the higher authorities of manufacturer of parts and car brand authorities.

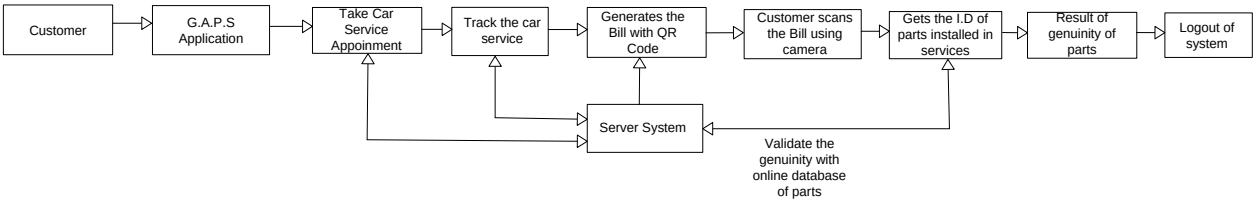

Figure 3 : Flow of Proposed System

VII. METHODOLOGY OF PROPOSED SYSTEM

7.1. Recognizing QR code through Camera in Mobile Phones:

For EAN barcode and QR code(2D barcode) many image recognition algorithms are there, thus QR code scanning is used in our application. In current mobile phones architecture an algorithm was developed for implementation of an application processor including DSP and embedded camera. For 1d barcodes, algorithm used spiral scanning method for detection of a key black bar, for 2D barcodes four corner detection method is used for code area finding. In the study, DSP and decoding used image processing part and in the host CPU of the application processor, user software part was implemented. Below are the following phases:

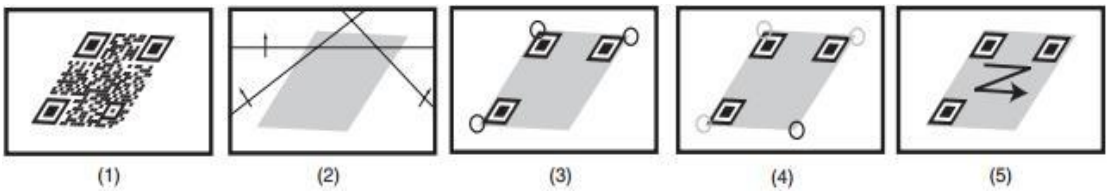

Figure 4 : Recognition of QR code's phases through camera in mobile phones

- **Pre-processing:**
  In algorithm gray level histogram calculation is adopted.
- **Corner marks detection:**
  Using finder pattern three marked corners is been detected.
- **Fourth corner estimation:**
  Special algorithm is used for the detection of the fourth corner of QR code.
- **Inverse perspective transformation:**
  To normalize the size of the code inverse transformation is adopted which depends on the obtained corner geometry positions.
- **Scanning of code:**
  Code is sampled inside and to host system the output is resultant normalized bi-level code data.

7.1.1. Pre-processing:

The YUV color space components (the luminance and chrominance) is in the camera interface of input image, and They used the Y component (the luminance), which had 8-bit (256 level) gray scale data, for that image processing. As the pre-processing, three steps of image processing were applied they are: histogram calculation to define the threshold of black-white boundaries in image, resizing of original image to reduce the calculation costs in the next phase: recognizing QR-code area in image, and the filtering for the area dilatation. In the histogram calculation, nine parts of 60x60 square areas nearby the image center were selected as sampling points for defining the threshold value between the black and white luminance levels to convert the bi-level images. As a center value of sorted density threshold in this area is calculated and, for selected area pixel density is sorted for each. After that, from the threshold of all selected areas according to results, minimum values is defined for that threshold. After the definition of threshold, the resized image which was scaled down into half for x and y coordinate directions, was been used for the original luminance component image to reduce calculations. Finally, the filtering, which worked for filling the holes (area dilatation), was used for recognizing the QR-code area. One pixel is assigned minimum density between four original pixels, and in their implementation, resizing process is also combined with this filtering.

7.1.2. Detecting code area:

For finding rough code area filtered and resized images are used and these process is shown below:

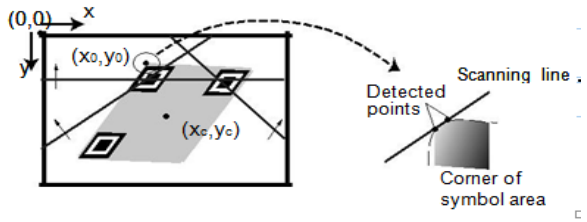

Figure 5: Detection of corners three scanning lines is used

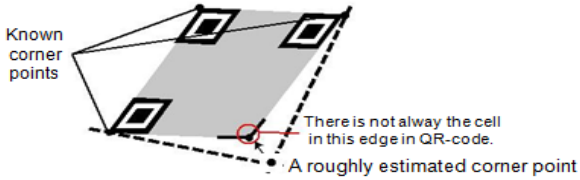

Figure 6:Detection method used for fourth corner

1. Assuming the center of image captured in Figure 5 position of gravity center(xc, yc) is calculated.
2. Until and unless the lines touches the image area, it scans the line from outer to inner in eight directions.
3. Their edge points are obtained, if there are two or more pixels present on line (Figure 5,right).
4. We get 16 points atmost, after scanning process of eight direction.
5. From many targets, one of the targets is point to (0, 0).
6. Define a vector P as $(x_0, y_0) - (x_c, y_c)$.
7. For finding other corner points inner product calculations are useful.

Positions of all corners are refined in original size after above process as follows.

1. Set a line from (x_0, y_0) to (x_c, y_c).
2. In outer edge of mark cross-point is present.
3. From cross-point position recursive area starts growing.
4. Get the gravity center of outer mark and this is in the inner mark.
5. Restart recursive area growing from the gravity center position.
6. Gravity center of inner mark is defined as Mark Center.
7. From the image center corner point is defined as the farthest point.

Using finder patterns helps in obtaining three corner points, but the fourth corner point has no found pattern, and also the case where there is no corner cell in the fourth corner exists. Because of these features of QR-code, we introduced the new corner detection algorithm for the fourth corner point reorganization.

1. Set a line from known corner points to roughly obtained point (Figure 6).
2. Move the cross-point so that line segments are shown by simply touching the code area (line attachment method).

The calculated code size as well as recognized code feature by the above processes can be used for verification of code specifications about the code size (code size is always odd), equally both width and height, and position of alignment mark before the process of de-coding (Figure 7).

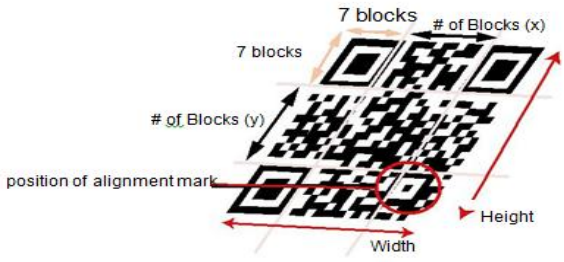

Figure 7: Based on size of pattern found having 7x7 cells is defined from the size of QR-code.

7.1.2. Inverse perspective transformation

As captured from the embedded camera device input image may have a deformed shape; for example, is Figure 8, and to normalize the code shape we use inverse perspective transformation method. This equation is shown as follows,

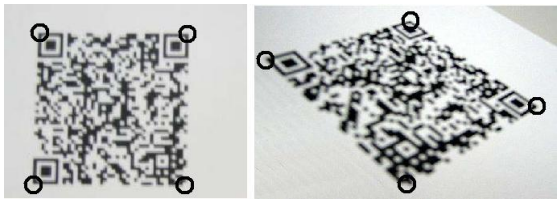

Figure 8: Capturing QR codes from two different positions by embedded camera in mobile phones.

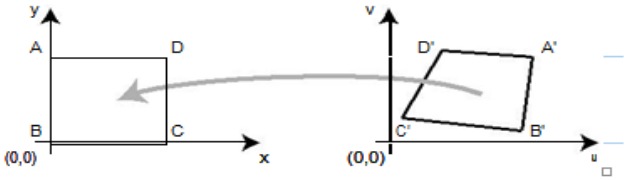

Figure 9: Inverse perspective transformation.

$$u = \frac{c_0x + c_1x + c_2}{c_6x + c_7y + 1} \qquad v = \frac{c_3x + c_4x + c_5}{c_6x + c_7y + 1}$$

Where original image is uv coordinate which is de-formed and normalized coordinate is xy coordinate. From following four point pairs(Figure 9),coefficients c0 ~ c7 can be obtained.

$$A(x_0, y_0) \Leftrightarrow A'(u_0, v_0), \quad B(x_1, y_1) \Leftrightarrow B'(u_1, v_1),$$

$$C(x_2, y_2) \Leftrightarrow C'(u_2, v_2), \quad D(x_3, y_3) \Leftrightarrow D'(u_3, v_3)$$

7.1.3. Code scanning

Using the clock and alignment pattern the general QR-code recognition method (specification mentioned method) is scanning, but based on four corner points they used the algorithm, the inverse perspective transformation method is used to scanned each cell in the code symbol directly. For scanning the QR code we used QR code scanning cordova plugin in our application.

VIII. ADVANTAGES OF PROPOSED SYSTEM

- Better User Interface.
- Helps the customer to check genuinity of automobile parts.
- Single customer can get appointments for his multiple cars at same time.
- Provides road side assistance to customers.
- Customers can get their past car service records on one touch.
- Real time tracking system for servicing of cars.
- Notification module specially designed for providing notification.

IX. DEMO OF PROPOSED SYSTEM

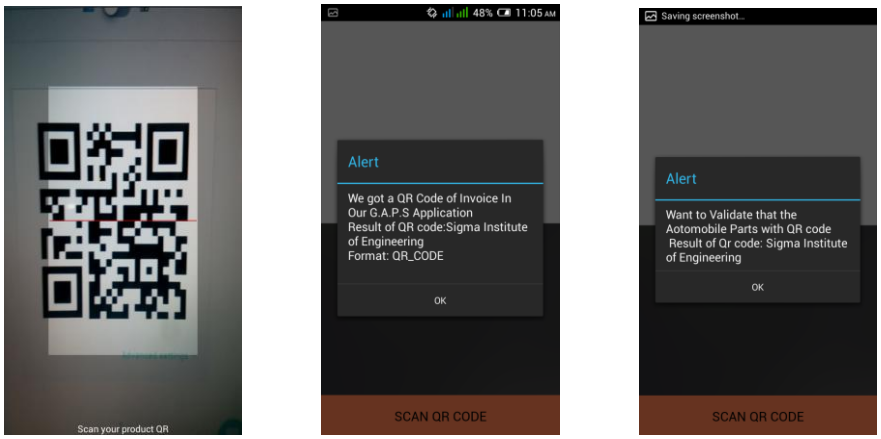

Figure 10: QR code Scanning and their results

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