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Electronic Taxi Meter Using QR Code Generator for Soft Payment

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ABSTRACT

Now a days, it seems necessary that usage of electronic services in different taxies are increasing. Because of this we face many problems like increasing taxi companies, payment problems, to thug passengers regarding money change etc. So we need to organize the system that will help to pay taxi electronically by the passenger and also reduce the need of carrying cash. Planning and building of such taxi system with latest coding technology feature. Many of the individual taxi drivers try to make passengers fool and charge high fare without any reason. We have implemented for individual taxi drivers, their own taxi system in which the fare is fix according to rate per kilometer with no extra timing charge and less tax.

Keyword : Quick Response (QR Code), Electronic Taxi Meter, Payment Bank.

I. INTRODUCTION

As, many of us have lots of problem for paying money to taxi drivers if our bill is not in perfect number. We have to give change in rupees which is sometime not possible. Because of this, passenger have an argument with driver. In addition to this, we waste our time in waiting to receive the rest of the money from the driver in case of not having change. Off course this result in enhancing the traffic, increase in consumption of fuel. So we need a technology to overcome the above problems. The technology can be intelligent taxi meter in which controller is used to generate QR code so that passenger will scan the fare and will pay it accordingly through soft payment.

For making our country smart with high technology we use many of the smart ideas in our country. Many of the transport systems uses car navigation, traffic signal control systems, cctv systems, wireless communication, RFID technology, number plate reading system, Bluetooth, audio etc. Taxies are also one of the parts of transport systems. Companies like OLA, UBER which are in high use now a days. This companies have app with features like communication between rider and driver, both are kept updated by the main system at different points, with the change in location of rider the address also changes automatically, selects the nearest driver to riders location. But this system is for individual taxi drivers who ride their taxi regularly in local manner for daily passengers with in the city. This system can also use for out of city ride. There is no central organization which will rule on every taxi. Each individual taxi driver will be its own owner. Drivers bank account number will be saved in controller so other organization will not be a part in contribution of profit.

Various displays are found in market for taxi meter like digital, analog, TFT, LCD, GLCD, 7segment etc. so to display QR code a display a used which will be connected to controller. QR code is a type of 2D barcode that can be access by smart phones or QR scanning application or devices. To access the code we must have to scan the code by QR scanner application that link directly to text, numbers, alpha numeric words, e-mails, URL, or any kind of data or information we want to display. Most of us have seen QR codes on advertisement, product packaging, tag of any brand, shop displays, websites, applications, bills, passes, newspapers etc. And soon will be seen on taxi meter.

II. GENERAL DESCRIPTION

The project is about electronic taxi meter which is going to be used by individual taxi driver for his own taxi. Taxi meter will be design with TFT display and QR code generator. The input for QR code generator will be

the amount of distance rode by the rider from source to destination. The meter will calculate the fare according to the distance rode by rider. The total amount will be displayed on display with the help of QR code. As the passenger scan the code by code scanner application the amount which is displayed have to be paid by passenger through payment bank or soft payment. The QR code contain the information about the driver such as drivers name, account number and the fare amount.

QR CODE:-

A special type of bar code. It encodes no. of alphabetical text, 0 to 9 numbers, URL, kanji etc. by using pixels pattern which is design in such a way so that it should be easy for optical scanners to read/capture in few seconds. It is first created by Denso-Waver, a Japanese Toyota subsidiary, in 1994 and was created for tracking vehicles during assembly of different parts.
It uses four standardized encoding modes (combination of 0 to 9 numbers, alphanumeric, byte/binary, kanji symbols) to efficiently store data. It consist of black squares (pixels) arranged in a square grid on a white background which can be read by an imaging device. It is readable optical label, contains information about data which is to be attach or displayed. It is very popular due to its fast readability and greater storage capacity compare to any other barcode.

The below figure shows the information about each pixel of code. The major blocks give the format information. According to this we save the version information, alignment, error correction and even in which pixels the data has to be stored. There are many ways to generate this code, such as websites, coding languages.

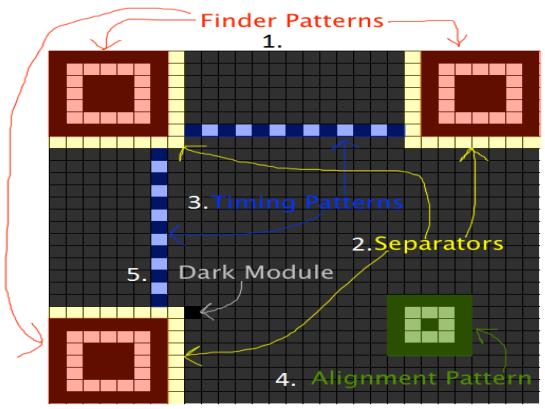


Figure 1. Format information

1. Finder patterns

It consist of three identical structures that are located in all corners of code except the bottom right one. Each pattern is based on 3X3 matrix of black modules with white pixels with again surrounded by black modules.

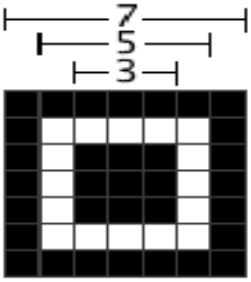


Figure 2. Blocks of finder pattern.

The size of a code can be calculated with the formula {[(V-1)*4] + 21}, where V is the QR code version.

2. Separators

It is the areas of whitespace beside the finder patterns. It is the lines of white modules, one vertical module wide, that are placed beside the finder patterns to separate them from the rest of the QR code. It is only placed beside the edges of the finder patterns that touch in between of the QR code. It improve the recognizability of the finder pattern to separate them from actual data. Used by scanning tool for recognizing the exact pattern of QR. Those white pixels at the edges are used for simplicity of scanning tools.

3. Timing Pattern

It consist of one after one alternate black and white modules which enables the decoder scanner software to determine the width of single module. The horizontal timing pattern in code is placed on the 6th row between the separators. The vertical timing pattern in code is placed on the 6th column between the separators. It always start and end with a dark module.

4. Alignment pattern

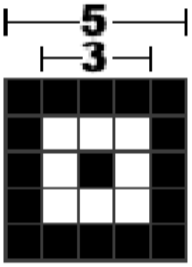


Figure 3. Blocks of alignment pattern.

It consists of a 5X5 module black square, an inner 3X3 module white square and a single black module in the center. The pixels at which the alignment patterns must be placed are defined in the alignment pattern location table. The numbers are to be used as BOTH row and column coordinates. For example, Version 2 has the numbers 6 and 18. It means center modules of the alignment patterns are to be placed at (6, 6), (6, 18), (18, 6) and (18, 18). The alignment pattern should not overlap in finder pattern.

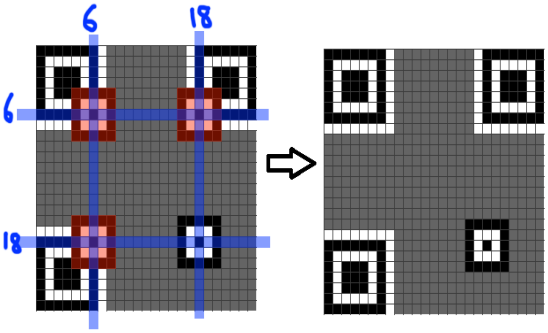


Figure 4. Example of Alignment pattern.

5. Dark Module

QR codes have a dark module beside the bottom left finder pattern. The dark module is located at the coordinate ([(4 * V) + 9], 8) where V is the version. It is located near the top-left finder pattern, a one-module strip must be reserved below and to the right of the separator. Second near the top-right finder pattern, a one-module strip must be reserved below the separator. Third near the bottom-left finder pattern, a one-module strip must be reserved to the right of the separator.

There are four levels of error correction that you can use from. The lowest is L, which allows the code to be read even if 7% of it is unreadable. M, which provides 15% error correction, then Q, which provides 25%, and H, which provides 30%.

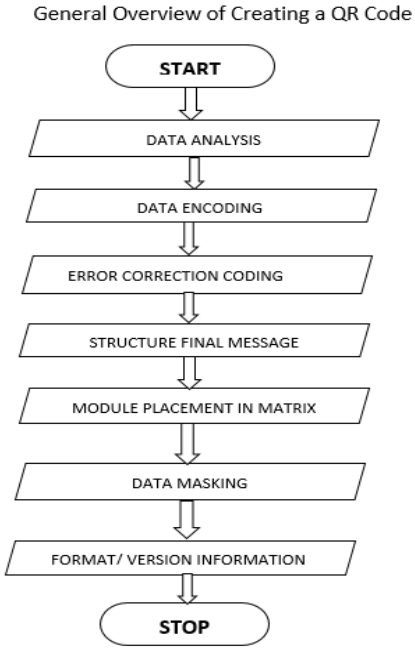
RASPBERRY PI 3 MODEL B

A raspberry pi model 3 B is used as a heart of meter. It will act as a microcontroller to control and monitor the taxi meter's distance with respect to time for fare calculation. Accuracy of controller should be high. As to generate the QR code we can't use embedded controllers because generation of code is possible only cause of operating languages like c, c++, java, php python.

Raspberry pi is a mini computer on which we can run linux based soft wares. Python is the language whose software is inbuilt installed in raspberry pi. So to generate code number of libraries are available in python. With the help of those libraries code has been generated.

The module has 40 GPIO pins which are used for TFT display and connection of wheels. The rotation of wheels will be counted and as per the count the distance travelled by the passenger will be calculated. The fare will be send to library of python and code will be displayed.

III. FLOW CHART TO GENREATE QR CODE



Step 1:- Data Analysis

This code encodes a string of text. The standard of code has four modes for encoding text: numeric, alphanumeric, byte, and Kanji. Each of the mode encodes the text as a string of bits in 1s and 0s, but each mode uses a different method for conversion of text into bits, and each mode of encoding method is optimized to encode the data with the shortest possible string of bits. So, the first step should be to perform data analysis to determine whether the text can be encoded in numeric, alphanumeric, byte, or Kanji mode, then select the most optimized mode for the text.

Step 2:- Data Encoding

After the selection of optimal mode, the next step is to encode the text. This section describes the process in detail for each encoding mode. The result of this step is a string of bits that it is split up into data codewords of each 8 bits long. Both the mode and string of bits are merged in one whole string.

Step 3:- Error Correction Coding

As discussed above, QR codes use error correction. This means after you split the string of data bits into codewords that represent the text, the string must use those bits to generate error correction code words using process called Reed-Solomon error correction. QR scanners scan and read both the data and error correction codewords. After comparing the two, the scanner will determine if it read the data perfectly, and it can correct errors if it didn't read the data correctly. The error correction coding section describes the process of generating error correction codewords.

Step 4:- Structure Final Message

The data and error correction codewords generated in the third step must now be arranged in the proper order. For large string of QR codes, the data and error correction codewords are generated in blocks, and those blocks must be interleaved according to the code's specification.

Step 5:- Module Placement in Matrix

After generating the data and error correction codewords and arranging them in proper order, they must be placed in the QR code matrix. They are arranged in the matrix in a specific way. During this, there should be arrangement of finder pattern in three corners.

Step 6: Data Masking

Some patterns in the QR code matrix can make it difficult for code scanners to read the code correctly. The QR code specification defines eight mask patterns, each of them alters the QR code accordingly to a particular pattern. Then determine which of these mask patterns results in the QR code with the fewest undesirable trend. This will be done by evaluating each masked matrix based on its four penalty rules. The final QR code must use the mask pattern which has lowest penalty score.

Step 7:- Format and Version Information

The last step is to add format and version information to the QR code by adding pixels in format areas of the code that were left blank in past steps. Then the format pixels identify the error correction level and the mask pattern being used in QR code.

IV. METER SYSTEM

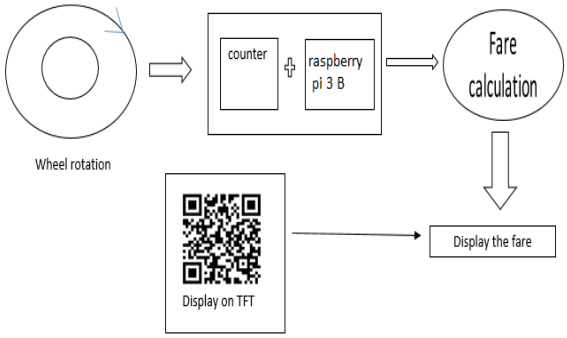


Figure 5. Block diagram of the system.

The working is: - As the wheel rotates the counter counts the number of rotations. The number of rotations are stored in controller. According to rotations, distance is measured. The measure distance and fixed fare per meter which is also stored in controller is used to calculate the total fare which is rode by the rider. The fare will be send to raspberry pi for generation of QR code.

1. Fare Calculation

A taxi meter can calculate charges in three ways:-

Distance traveled in the taxi "hired" mode: - The meter is connected to a device inside the vehicle with a speed sensor or distance sensor which is going to provide information on distance traveled via pulses corresponding to revolutions of the transmission. The meter, a small computer i.e. Raspberry pi, uses this information to generate the actual distance traveled, and computes the fare based upon a program stored in the meter, and displayed information relating the meter to the exact vehicle in which it is mounted.

Time accumulated in the hired (on) but taxi is in stopped mode. ("Waiting time"):- The vehicle is considered in stopped mode when the vehicle is traveling from source to destination in passenger needs to stop at store or "Wait here, I'll be right out" situation. This allows the grid locked cab not to make money based on time used by passenger, and to allow the meter

to run while the cab is stopped. The fare is then based upon a programmed amount of money but will not increase because of time.

Flat rate charges called "extras". There is a feature called "Extras" in now a days meters. No of fares can be programmed and added to the total fare with a touch of a button marked 'extras" on the meter face. The extra charges are such as Airport Fees, toll bridge charges, or similar recurring fees.

The speed is worked out as:-

$$\frac{\text{Distance (metres)}}{\text{Time (seconds)}} \times \frac{3600}{1000} \left(\text{km/h}\right) = \text{SPEED}$$

Pulses

The taximeter calculates the distance/time charging

The taximeter finds out the distance travelled by the taxi through count of rotation a wheel take place. The sensor will sense each rotation and counter will count those rotation. With the help of count the distanced travelled in calculated. Each pulse represents a rotation of wheel. This distance depends on the mechanics of the vehicle, but let us assume that each pulse represents 1 meter. So a series of pulses would represent distances as below:

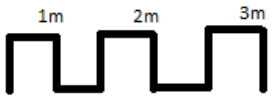
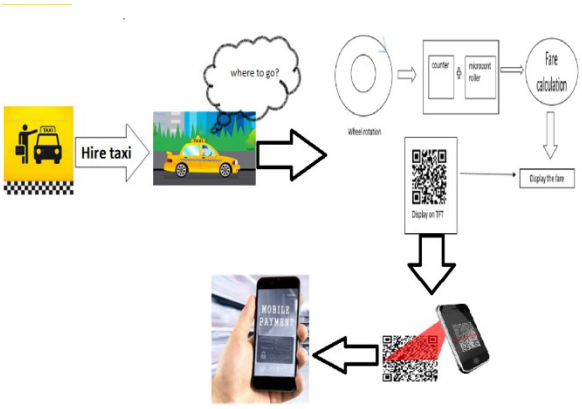


Figure 3. Figure of pulses

2. Flow From Hiring Taxi To Scanning Code

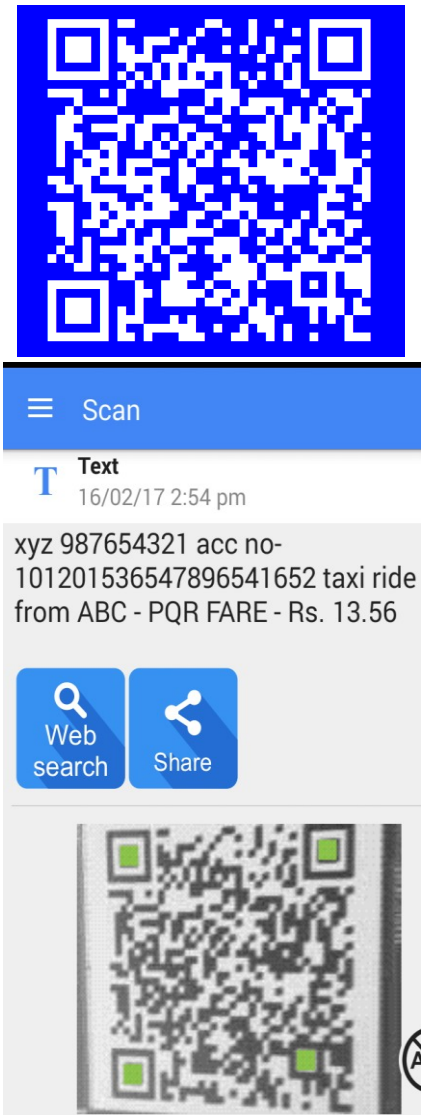


To make lifestyle easy and faster we need to live with the flow of technology for being smart. Following are the important keys for technology used in this implementation

- No need to carry cash.
- Security for banking-grade
- Convenient
- Fast
- Reliable
- Safer solution for the passenger
- Quality assurance: better
- No need of maintenance and handling cash.

V. RESULTS

Here, is the result of meter, as the demo wheel is of 20.8 inch, and it took 1304 rotations. So the fare calculation took place and the following QR code has been generated with full information of driver:-



As per the rate of 6 Rs per Km the fare has been generated is 13.56.

The second snap is about the scanned code output on phone. Fare 13.56 is displayed with XYZ named drivers account no.

VI. CONCLUSION

This electronic system took one year to be done and led to plan, design and implement a system which is used to pay the taxi fare electronically. It also solve many problems related to money change, accuracy, to save peoples from getting fool or cheat by drivers. There are some prominences such as: To save wastage of time, receive money from passenger on time without any argument and creating bank facilities for drivers.

VII. ACKNOWLEDGEMENT

We would like to express our sincere thanks to our guide Prof. Salunke sir and our college department. Also thanks to all teachers for their guidance, support and co-operation into nurturing this project idea.

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