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lines, escaping from toll plazas etc. These systems can service only 300 vehicles per hour, and if more than that number of vehicles arrive at that plaza, server traffic jams may occur. To solve this we are proposing to create geo-fences using GPS by giving latitude and longitude of the corner of the toll plaza. By comparing the position of the vehicle and toll plaza, the owner of the vehicle can be charged from the account.

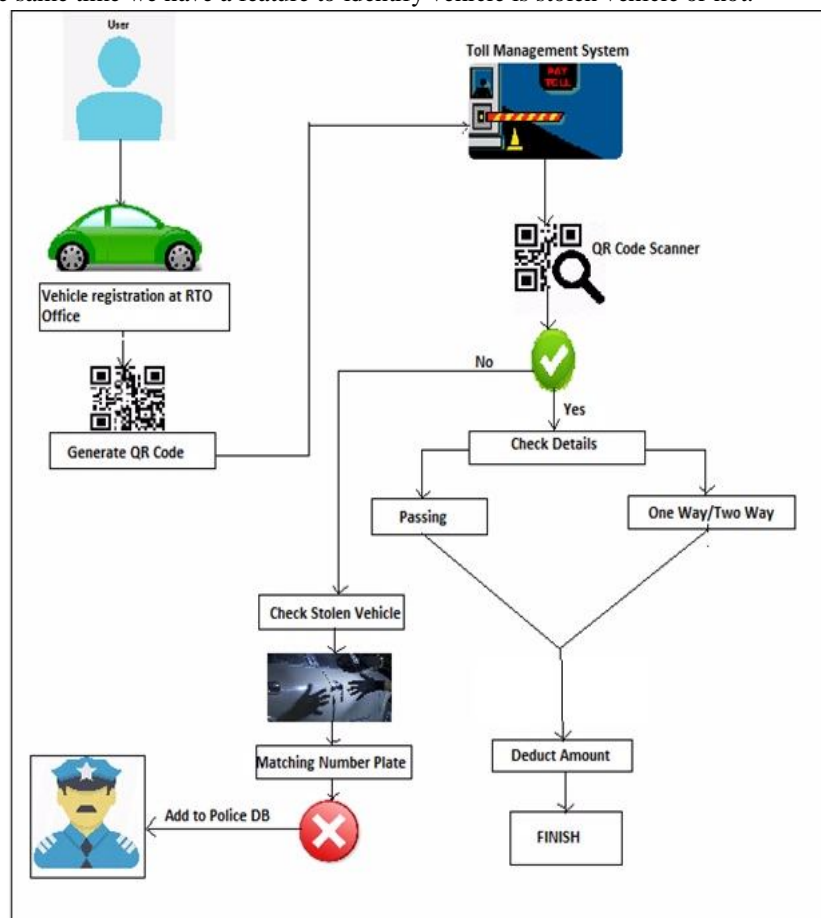
**B. Automated Toll Collection With Complex Security System**

1) *Author:* P. Kamalakannan; M. Balaji; A. Avinash; S. Keerthana; R. Mangayarkarasi

2) *Abstract:* The paper is concerned with automated toll collection system using the active RFID tags; vehicles are made to pass through a sensor system that is embedded on the highway just before the tollgate. The system will electronically classify the vehicle and calculate the exact amount to be paid by the vehicle owner, ensuring no pilferage of the toll amount. Vehicle owners, who frequently pass through tollgates, are required to have a prepaid smartcard, which will deduce the appropriate amount, by using an automated smart card reader [1]. A Micro controller consists of a powerful CPU tightly coupled with memory RAM, ROM or EPROM), various I / O features such as Serial ports, Parallel Ports, Timer/Counters, Interrupt Controller, Data Acquisition interfaces-Analog to Digital Converter (ADC), Digital to Analog Converter (DAC), everything integrated onto a single Silicon Chip. The Microcontroller is connected with personal computer through RS232 data adapter

**III. PROPOSE SYSTEM**

Combination of toll collection and vehicle identification system is included in proposed system. User registers on system, after registration QRcode get generated. QRcode contain all the information about vehicle and vehicle's owner. At tollbooth, toll collector will scan QRcode and identify user and vehicle. Also he checks user is prepaid user (pass holder) or regular user. If user is regular user then deduct amount according to method, or two way traveling toll charges. Every time after renewing of pass; generate new QRcode. If user is Pass holder he will be allowed to proceed and if user is regular user the respective charges will deduct after scanning of qr code. At the same time we have a feature to identify vehicle is stolen vehicle or not.



#### IV. MATHEMATICAL MODEL

Let S be the system Where  $S = I, O, P$  Where, I = Set of input O = Set of output P = Set of technical processes

Let S is the system

$S = s, e, X, Y, AES, DD, NDD$

s- Initial State: no user login • e- End state: Allow toll paid user

X- Input Login id, password, user's QR-Code

Y- Toll collection (transaction)

AES- Advanced Encryption Standard (AES) for user data encryption.

• DD- Deterministic Data: Customer information • NDD- Non Deterministic Data: QR-Code

I=user QR-Code

User QR-Code: QR-Code hold all information of user and vehicle.

O=transaction

Transaction= toll calculated according vehicle type.

$P = UE, UA, VA, CT, UT$

1) UE= User information encrypted by AES and stored into QR-Code.

2) UA= User Authentication= user authentication is done.

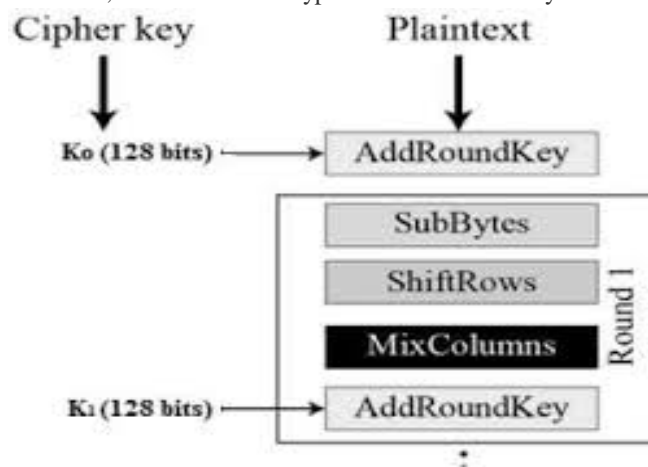
3) VA= Vehicle Authentication= vehicle authentication is done.

4) CT = calculate toll according to vehicle type

5) UT= identify user type (pass holder/ non pass holder)

#### V. IMPLEMENTATION OF ENCRYPTION USING AES METHOD.

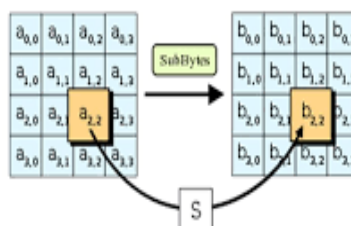
The encryption process uses a set of specially derived keys called round keys. These are applied, along with other operations, on an array of data that holds exactly one block of data; the data to be encrypted. We call this array as the state array.



##### A. Byte Substitution (Sub Bytes)

The input bytes are substituted by looking up a fixed table (S-box) given in design. The result is in a matrix of four rows and four columns.

##### 1. The SubByte Step

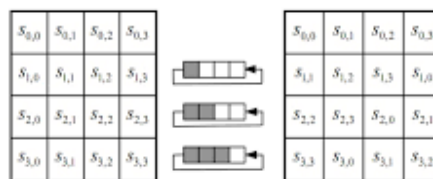


**B. Shiftrows**

Each of the four rows of the matrix is shifted to the left. Any entries that ‘fall off’ are re-inserted on the right side of row. Shift is carried out as follows –

- 1) First row is not shifted.
- 2) Second row is shifted one (byte) position to the left.
- 3) Third row is shifted two positions to the left.
- 4) Fourth row is shifted three positions to the left.
- 5) The result is a new matrix consisting of the same 16 bytes but shifted with respect to each other.

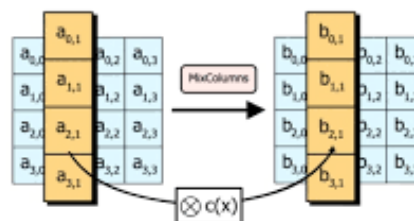
• Shift Rows



**C. Mix Columns**

Each column of four bytes is now transformed using a special mathematical function. This function takes as input the four bytes of one column and outputs four completely new bytes, which replace the original column. The result is another new matrix consisting of 16 new bytes. It should be noted that this step is not performed in the last round.

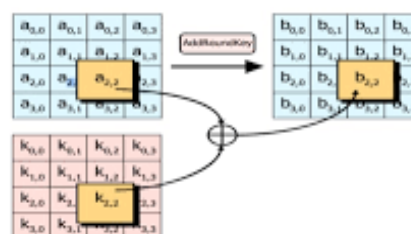
• Mix Columns



**D. Addroundkey**

The 16 bytes of the matrix are now considered as 128 bits and are XORed to the 128 bits of the round key. If this is the last round then the output is the cipher text. Otherwise, the resulting 128 bits are interpreted as 16 bytes and we begin another similar round.

• Add round key



**VI. CONCLUSION AND FUTURE SCOPE**

QR-Code is effective way to store information and handle stored knowledge. We propose effective and transparent toll collection system. Toll collector just need to scan QR-Code; all other operations are done automatically. Automation in toll collection reduce the time required for toll collection. Also propose system is capable of identify vehicle is stolen or not. This feature will track stolen vehicle.



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