

STANDARDIZATION OF TOLLING TECHNOLOGY – ELECTRONIC TOLL COLLECTION (ETC)

Arun Kumar Jha¹, Dr. B.V.Khode

¹Civil Engineering department, G.H. Raison College of Engineering, Nagpur, (India)

²Professor, Civil Engineering Department, G.H.Raison College of Engineering Nagpur (India)

ABSTRACT

This work presents the need for standardization of Electronic Toll Collection (ETC). Automatic Toll collection system using RFID used for collecting toll automatically. RFID system uses tags which are nothing but unique identification numbers that are mounted on windshields of vehicles, through which information embedded on the tags are read by RFID readers. ETC system eliminates the need for motorists and toll collectors to manually perform ticket payment and toll fee collection, respectively. Toll information can be easily exchanged between the motorists and toll authorities, thereby enabling a more efficient toll collection by reducing traffic and eliminating possible human errors. This system is implemented in NH-1 project as a pilot project.

Keywords ETC; RFID; Tags.

I INTRODUCTION

Larger percentage of operation Toll plazas on National Highway network are operated manually in absence of basic tolling infrastructure and automation. Even AVC is not in place. ETC is a technology automate the toll collection process their by reducing the long queues at toll booths using the RFID tags installed on the vehicle.

II CASE STUDY

With an objective of paving way for a unified ETC technology for National Highways in India, the Ministry of Road Transport & Highways constituted a committee chaired by Mr. Nandan Nilekani with a mandate to examine all available technologies for ETC.

The Committee submitted its report in July 2010 recommending RFID based on EPC Gen-2, ISO 18000-6C Standards for Electronic Toll Collection in India, which has since been accepted by the Government.

Upon acceptance of the RFID Technology, an Apex Committee was constituted in March 2011 for suggesting the operational methodology for implementation and operation of the ETC system.

September 2011, Apex Committee released its report on operational methodology for implementation and operation of the ETC system”.

Subsequently after Apex committee report on operational methodology for implementation and operation of the ETC system. Ministry of Road Transport & Highways and NHAI initiated Pilot ETC implementation on 4 sections of NH1 through IHMCL.

All 4 concessionaires operating in 4 different sections of NH1 agreed for this pilot along with ICICI bank (Suggested by NHAI as Central Clearing House partner).

Very few plazas have space and lane available to accommodate 1 active and 1 standby ETC lane with ejection facility in each direction of travel. One ETC lane with ejection facility requires 2 dedicated toll lanes, that means at any present 12 lanes toll plaza, 8 lanes shall be utilized as ETC lane and only 4 lanes will be left for Cash, exempt, non-toll able traffic.

III ETC Arrangement

Etc mainly has six components.

1. **The entrance:** at this point the vehicle presence and the Tag status are detected. This detection is used by the ETC Lane controller to direct the approaching vehicle
2. **First Indication Point:** at this point only the vehicle presence is detected. Here an appropriate visual guidance to the user is provided on which exit (ETC or Mixed / Manual cash) will be allowed for the vehicle.
3. **Second Indication Point:** at this point again the vehicle presence is detected. Here again an appropriate visual guidance to the user is provided on which exit (ETC or Mixed / Manual cash) will be allowed for the vehicle.
4. **The ETC exit:** the vehicle exiting through this exit enters the transaction region (where the ETC transaction occurs).
5. **The Mixed/Manual exit:** the vehicle exiting through this exit is allowed to enter an adjacent lane where a different method of payment (Smart card or cash) can be chosen or the hand held RFID reader can be used in the event of ETC lane malfunctioning. Hand held RFID reader shall be integrated with this adjacent Mixed/Manual exit lane to facilitate such transaction.
6. **Transaction region:** at this point a complete detection is done (AVC classification and Tag status). This detection provides data for the ETC transaction. The distance between the Entrance region and the ETC Transaction region is at least 60m



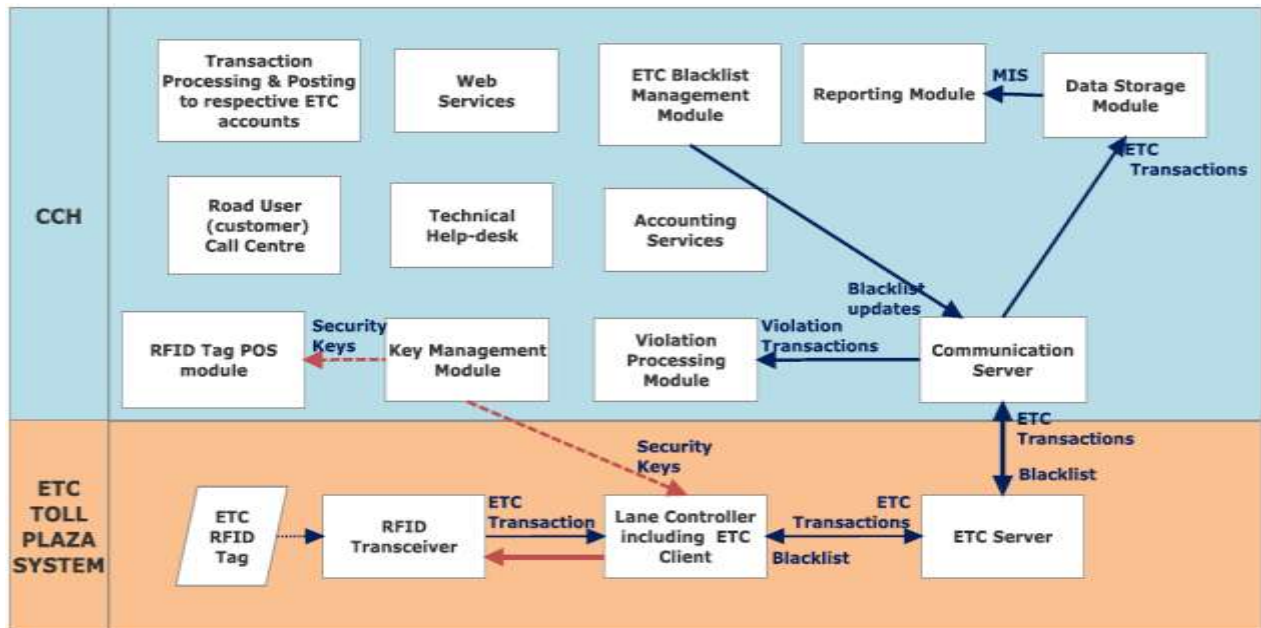
Fig. 1. General arrangement of ETC lane

Tag Authentication

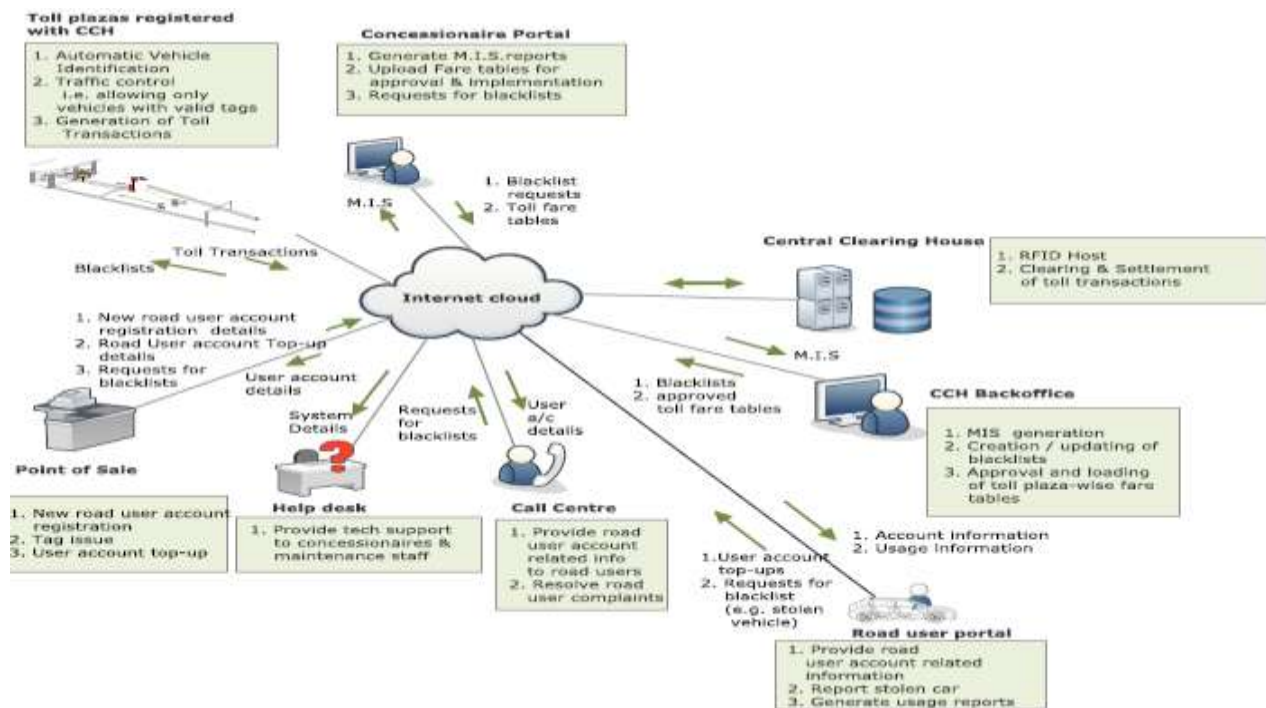
- Valid Issuer Agency Check (ICICI/Axis, etc)
- Valid Header Check (Unique Header Code)
- Vehicle Class Check (Not equal to 00 or FF)

Tag Blacklist Reasons

- Due to Misuse
- Due to insufficient balance/expiry of validity period



Nation-wise ETC Program – Main data flow:



Schematic Nation-wide ETC program:

Sample Data – BLACKLIST & DISCOUNT files

BLT

```
#HEADER,TPCCH,LTPTP,BLT,2012/06/06 23:59:59,0000000002,PTP0101010¶  
01100110,A, 2012/06/06 23:59:59,¶  
01100111,R, 2012/06/06 23:59:59,321¶  
#TRAILER,0000000002¶
```

DIS

```
#HEADER,TPCCH,LTPTP,DIS,2012/11/01  
23:59:59,0000000002,PTP0101010¶  
10001713,91000002201000000009,684743140614301600972809,AP09AC272  
7, 2012/10/01,2012/11/01,LP,Local Commercial Traffic,A¶  
10001714,91000002201000000008,684743140614301600972808,AP09AC272  
6, 2012/10/01,2012/11/01,MP,,D¶  
#TRAILER,0000000002¶
```

Sample Data – TOLL Transaction file

```
#HEADER,LTPTP,CCH,TOLL,2013/01/30 11:09:09,0000000005,0000000000,1000¶  
8009123,021000,L1,2013/01/30 10:15,0,0,990000000010000003D4,2013/01/30  
10:15:00,04,24,,,,,,,,,AP09CE0982,,,,,P,,,,,,,,, ¶  
8009124,022000,L2,2013/01/30 11:15,1,0,990000000010000003D5,2013/01/30  
11:15:00,03,23,l2imagewide,2013/01/30 11:15:00,l2rearimg1,2013/01/30  
11:15:02,O,N,,Serial,0,0,,AP09CE0982,1,,,,P,,,,,,,,, ¶  
8009124,022000,L2,2013/01/30 11:15,1,0,990000000010000003D6,2013/01/30  
11:15:00,03,23,l2imagewide3,2013/01/30 11:17:00,l2rearimg4,2013/01/30  
11:17:12,,,,,,,,,AP09CE0934,1,,,,P,,,,,,,,, ¶  
8009124,024000,L2,2013/01/30 11:15,0,0,990000000010000003D7,2013/01/30  
11:15:00,03,23,,,,,,,,,AP09CE0935,,024010,L1,2013/01/30 10:15,D,,,,,,,,, ¶  
8009127,021000,L1,2013/01/30 10:15,0,0,2013/01/30  
10:15:00,04,24,,,,,,,,,AP09CE0982,,,,,P,1,200.45,200.45,,,,,,,,, ¶  
#TRAILER,0000000005¶
```

Sample Data – Transaction & Violation Re Conciliation file.

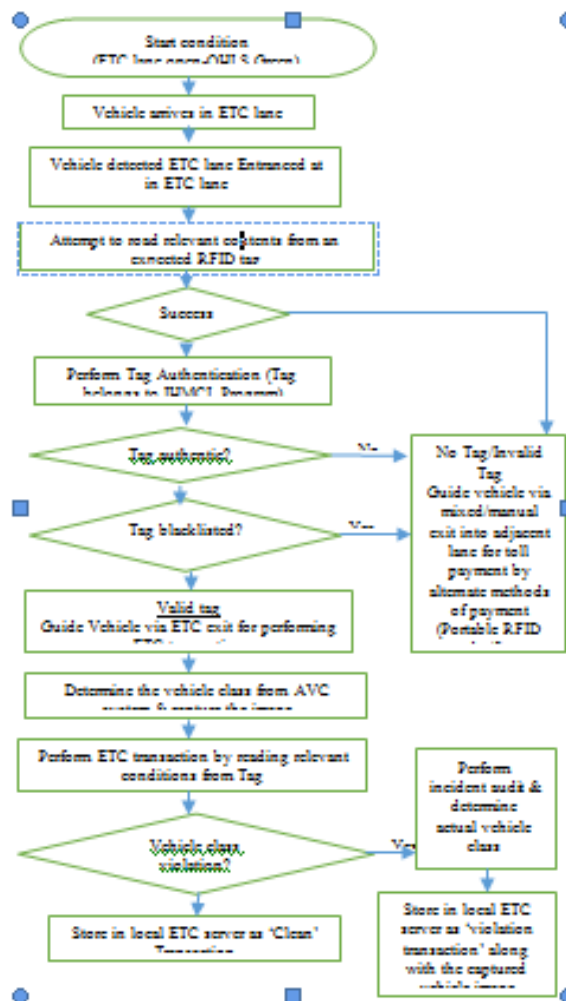
TRC

```
#Header, TPCCH,LTPTP,TRC,F,2012/06/06 23:59:59,2012,0000000002,  
0000000003,00.00,00.00 ,PTP0101011, PTP0101010¶  
011001001,0110212122,W,W1,2012/06/06 23:59:59,01100110,2L, 10.00, ,A,  
,AP09BK4890,¶  
011001002, 0110212123,W,W1,2012/06/06 23:59:59,01100110,2L, 10.00,10.00,AD,  
,AP09BK4890,¶  
011001003,0110212123,E,E1,2012/06/06 23:59:59,01100110,2L,  
10.00,10.00,R,012,AP09BK4891,¶  
#TRAILER ,0000000003¶
```


VRC

```
#Header, TPCCH,LTPTP,VRC,F,2012/06/06 23:59:59,00000000002,
00000000003,00.00,00.00,PTP0101011, ¶
0001100100,1020023123,W,W1,2012/06/06 23:59:59,01100110,2L, 10.00, ,A,
,AP09BK4890 ,PTP0101010¶
0001100101,1020023124, W,W1,2012/06/06 23:59:59,01100110,2L, 10.00,10.00,AD,
,AP09BK4890,PTP0101010¶
0001100102,1020023125,E,E1,2012/06/06 23:59:59,01100110,2L,
10.00,10.00,R,012,AP09BK4891,PTP0101010¶
#TRAILER ,00000000003¶
```

ETC Transaction Flow at lane level:



IV WAY FARWADED AND CHALLENGES.

Today, Nonstandard toll automation software and hardware implemented across National Highway network. Every system is unique in terms of its platform, database, its architecture, topology, protocols etc. E.g. class code used and written into the database as well on media is different for each system and sometimes specific category of vehicle is classified differently on different toll plazas.

To achieve Nationwide interoperability, following minimum initiative is required, prior to its launch.

- Automation of toll plaza and lanes.
- Standardization of toll automation system software and hardware in terms of basic architecture.
- Expansion of existing operational toll plaza to adopt ETC lane and provision in upcoming toll plazas.

V RESULT AND CONCLUSION

Present status of interoperable ETC implementation across India.

IHMCL formation (NHAI jointly with its Concessionaires and Financial Institutions incorporated Indian Highways Management Company Limited (IHMCL) on 26.12.2012 under the Companies Act, 1956 to carryout Electronic Tolling and other ancillary projects of NHAI. Indian Highways Management Company Limited (IHMCL) was incorporated on 26.12.2012 under the Companies Act, 1956 to carryout Electronic Tolling and other allied works by NHAI jointly with its Concessionaires and Financial Institutions. The shareholding pattern of stakeholders is NHAI-25%, Concessionaires-50% and Financial Institutions-25%. The authorized capital of the Company is Rs 40 Crore).

- IHMCL has established two CCH operators Axis Bank and ICICI Bank for Pan India operation. SLA is signed between both CCH operators and IHMCL, and all concessionaire has signed Deed Of Adherence with IHMCL in confirmation to comply with SLA signed between IHMCL and CCH operators.
- NHAI through IHMCL implementing ETC lanes at public funded projects.
- Concessionaire is responsible to implement ETC lane at their respective projects.
- Interoperable ETC is operational at NH-8 between Ahmadabad & Mumbai and 30/04/2015 is target date to go line with interoperable ETC across country

REFERENCES

1. Report by Apex Committee for ETC implementation Govt. Of India, July 2011.
2. Recommendation for Electronic Toll Collection (ETC) technologies for National highways in India, Report by Nandan Nilekeni committe, july 2010