

# Implementation Of Smart Contract

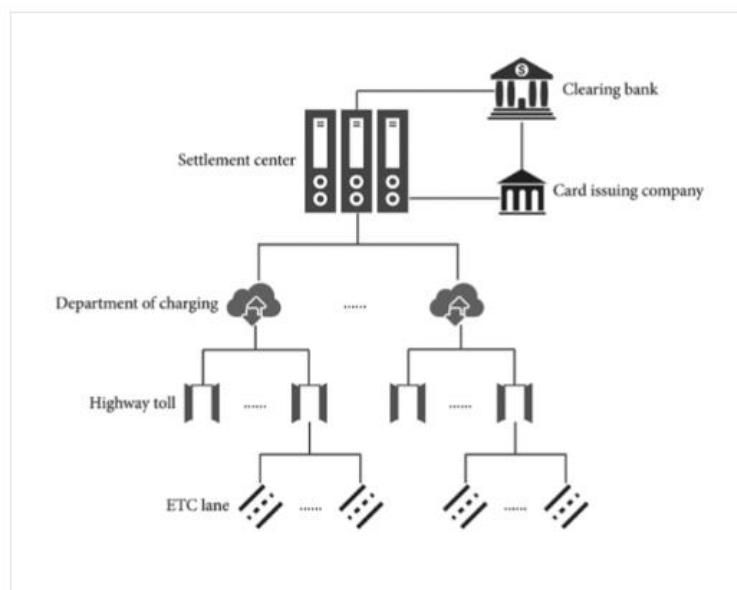
## Using File Connector.Js

Team ID	NM2023TMID04427
Project Name	Project – Tracking Public Infrastructure And Toll Payment Using Blockchain

### The Working Process Of An ETC System Is Described As Follows:

- 1) A driver purchases an electronic label (OBU) and a prepaid IC card from a card issuing company
- 2) The driver inserts the IC card into the electronic label (OBU) that has been installed in the vehicle
- 3) When the vehicle passes through a tollgate, RSU reads its OBU information through wireless communication
- 4) The computer in the toll station generates transaction data
- 5) The computer uploads the transaction data to a settlement center
- 6) The settlement center conducts calculation, and the clearing bank transfers the profit to the highway company which the toll gate belongs to

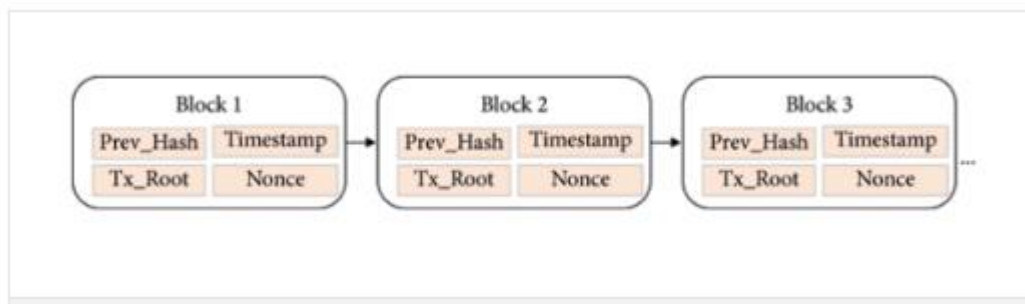
### Framework :



ETC adopts the layered-cascade architecture to deploy toll booths, toll stations, and a settlement center [12]. As shown in Figure 1, toll data are transmitted from toll booths to the settlement center.

### Concept Of Blockchain :

Blockchain was proposed by Satoshi Nakamoto in his very first paper as the underlying technology and infrastructure of Bitcoin [13]. It links data blocks in chronological order using cryptography to guarantee a nontamperable and unforgeable distributed ledger. Each block in a blockchain initially contains three elements: ID of the block, certain transaction information, and ID of the previous block. Each ID is uniquely identified by a hash value.



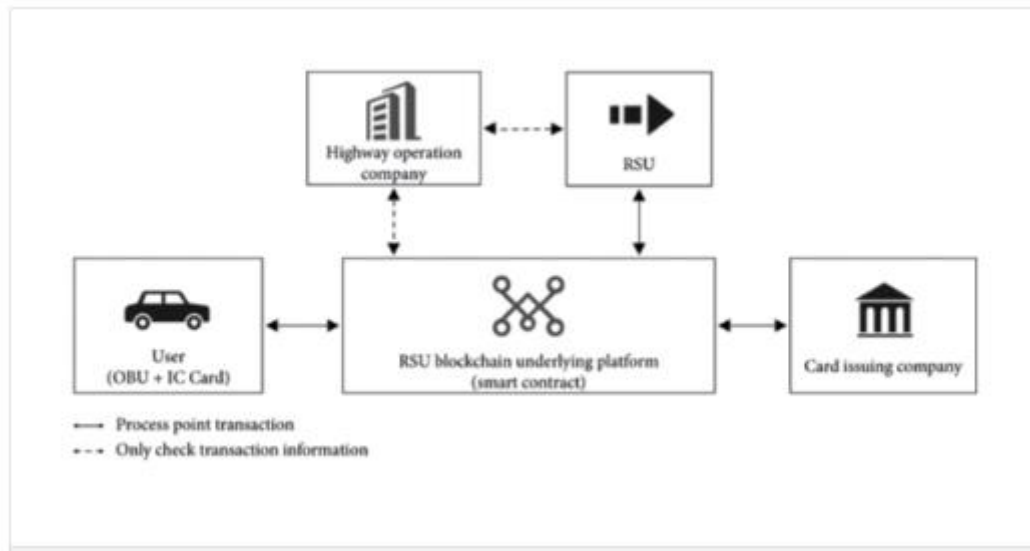
### An ETC System Based On Blockchain :

Targeting security issues of ETC systems, we propose a new ETC architecture based on smart contract and blockchain. The architecture simplifies toll payment and settlement while retaining all the functions and most of the infrastructure and equipment of original ETC systems.

### Framework :

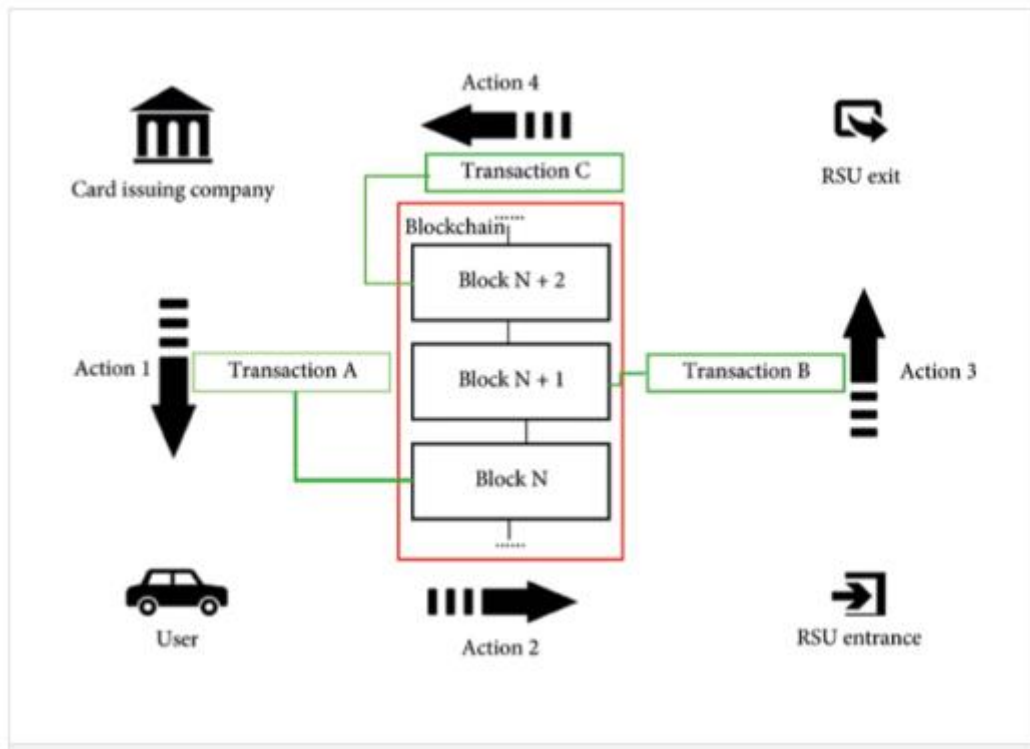
1. *Blockchain Underlying Platform.* The platform records transaction information of RSU, users, and card issuing companies through smart contracts and forms a blockchain.
2. *Users.* This unit includes OBU and IC card. OBU stores vehicle information, and the IC card records account points. Each user holds his own private key and public key.
3. *RSU.* An RSU is divided into an RSU entrance and an RSU exit. The entrance only interacts with users and does not perform point transactions. The exit has its own private and public keys and conducts point transactions with users and card issuing companies.

4. *Card Issuing Company.* This organization issues OBUs and IC cards. It can also redeem cash points for users.
5. *Highway Company.* It manages RSUs of its own. First, it collects earning points of all its RSU exits through the blockchain underlying platform, and then asks the card issuing company to transfer the corresponding payment. Notably, highway companies do not participate in point transaction but check transaction information on the blockchain and store private key addresses of their own RSUs.



### Typical Scenario :

Action 2 indicates the RSU entrance records the user's information. Action 3 means the RSU exit charges the user. Action 4 means the card issuing company transfers the money to the highway company that the RSU belongs to according to the RSU exit's income. Transaction A represents that the card issuing company assigns certain points to the user's account. Transaction B means that the user's account transfers certain points to the RSU exit account. Transaction C means that the RSU exit account transfers certain points to the card issuing company account.



Once a transaction is completed, a new block will be created in the blockchain and the transaction information will be recorded in the block. As illustrated in Figure 4, the information of Transaction A is written in block N and that of Transaction B in block N + 1. In this way, the blockchain can store the information of all transactions.