

AutoLedger

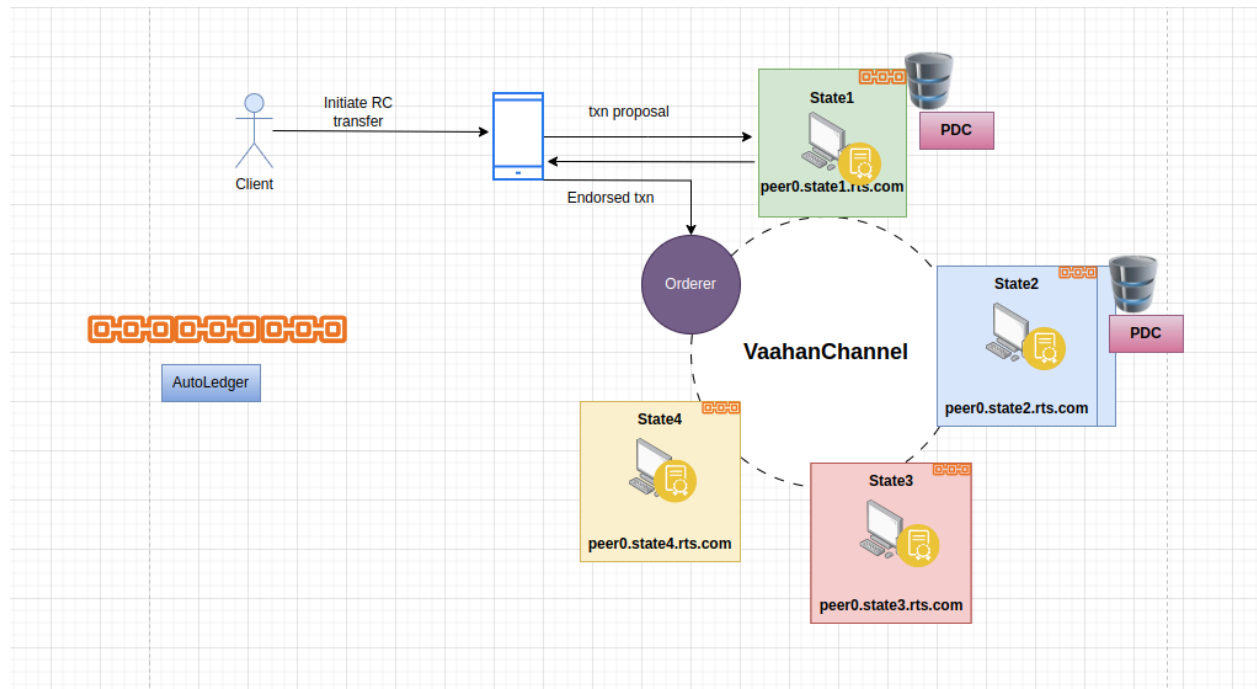
Problem Statement

The process of transferring a vehicle's registration certificate (RC) from one state to another is currently manual, time-consuming, and prone to errors. It involves multiple state transport departments, often leading to delays and discrepancies in records. There's a lack of transparency and traceability, which can result in fraudulent activities, such as duplication of RCs or illegal transfers. The current system also lacks a unified platform where all the stakeholders can interact seamlessly, making the process cumbersome for both the authorities and vehicle owners.

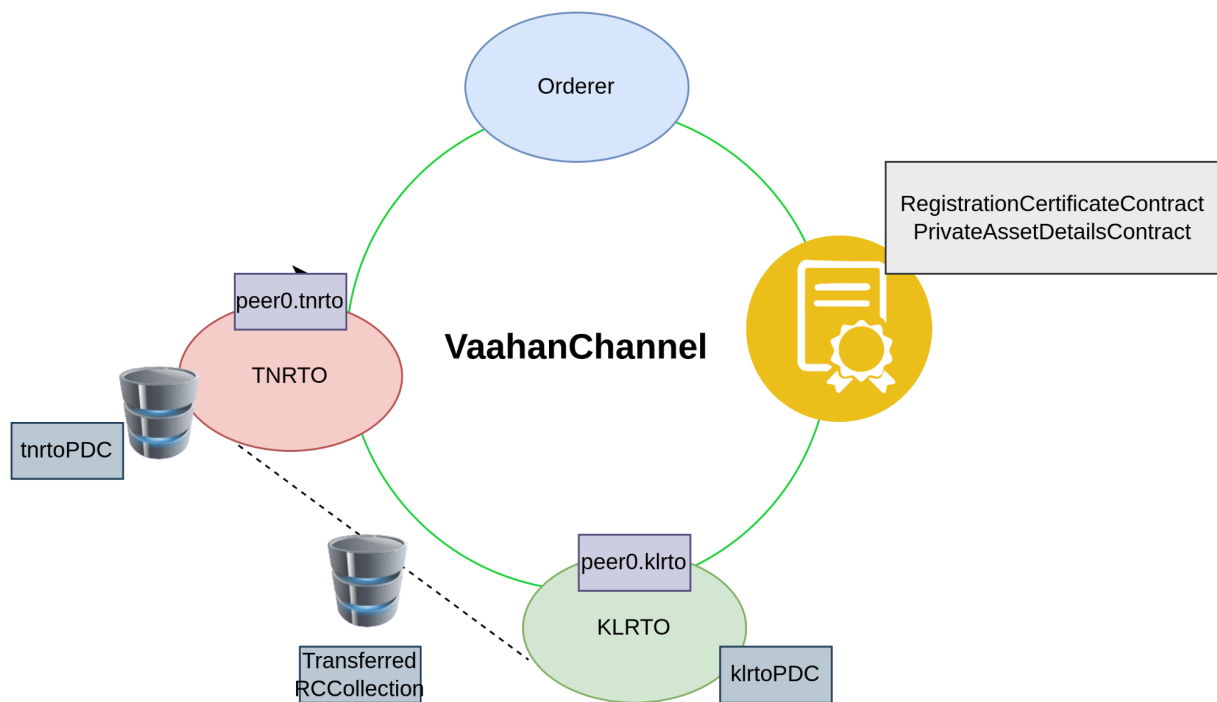
Proposed Solution:

To address these challenges, we propose a blockchain-based solution using Hyperledger Fabric, named **AutoLedger**. This solution will facilitate the secure, transparent, and efficient transfer of vehicle RCs between states. By leveraging a permissioned blockchain network, we can ensure that only authorized parties can access and update the records, thus maintaining the integrity of the data.

HighLevel-Architecture



Network Diagram



Key Features of the Proposed Solution:

- **Decentralized Ledger:** A distributed ledger that records every transaction related to the RC Creation, transfer, deletion, ensuring transparency and traceability.
- **Private Data Collections (PDCs):**

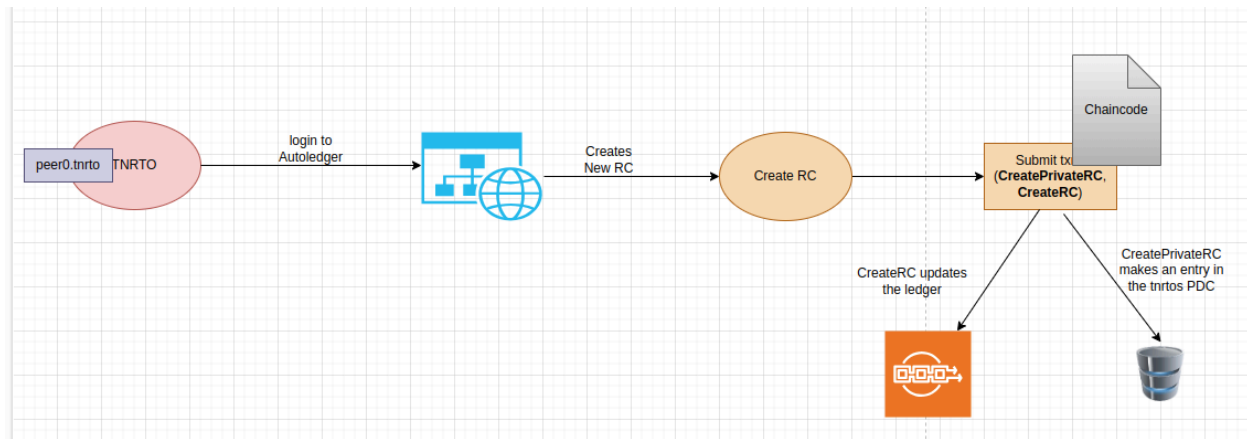
Each state maintains its own PDC, ensuring that sensitive information is only accessible to authorized entities within that state.

statePDC(eg.**tnrtoPDC**,**klrtoPDC**) has its own private data of Registration Certificates.

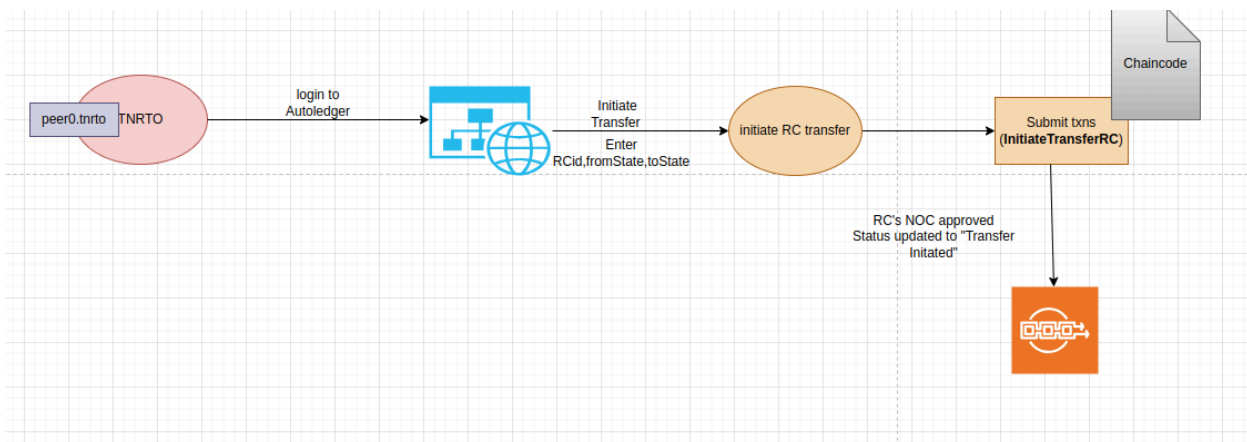
TransferRCCollection has the collection of TransferredRC which are dis-owned by the current state. This collection will be accessed by other authorized states to check and add it to their statePDC

WorkFlow

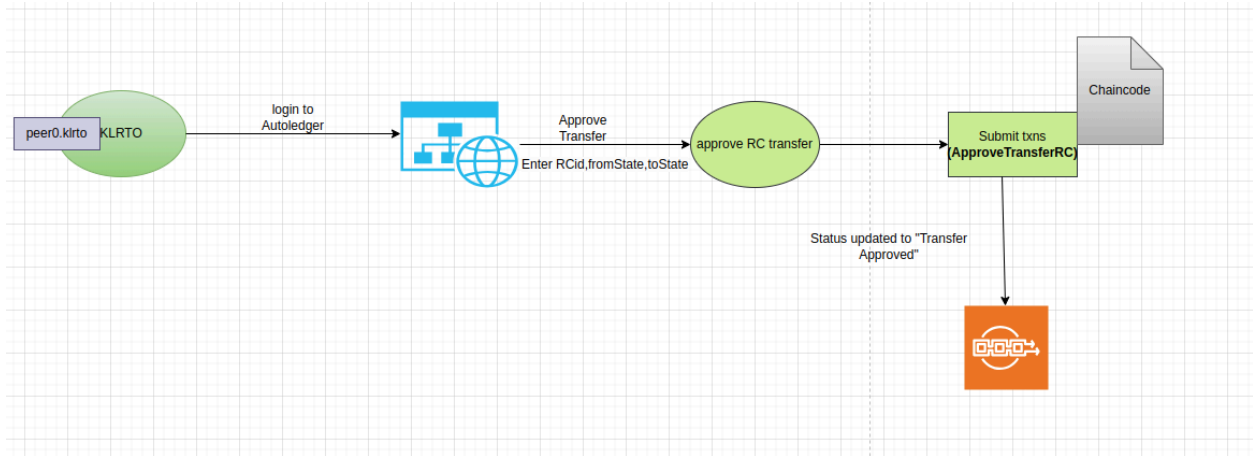
Create RegistrationCertificate



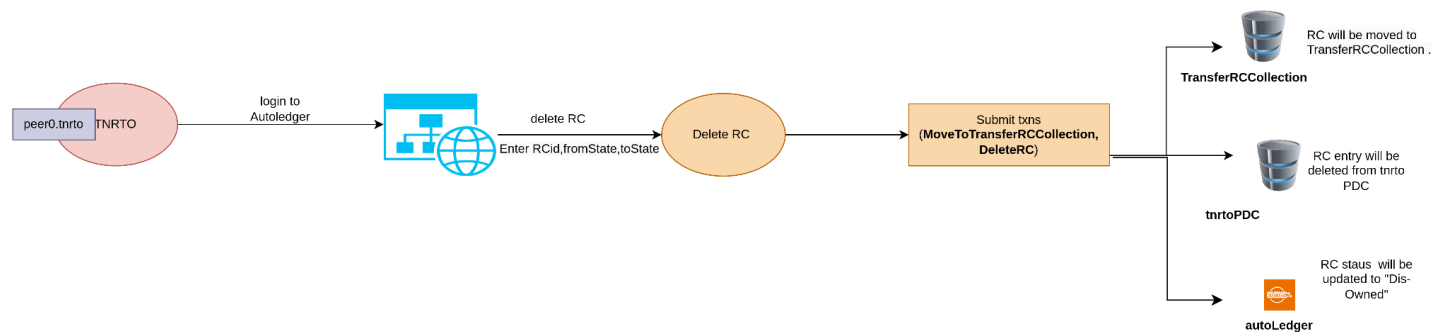
Initiate Transfer RC



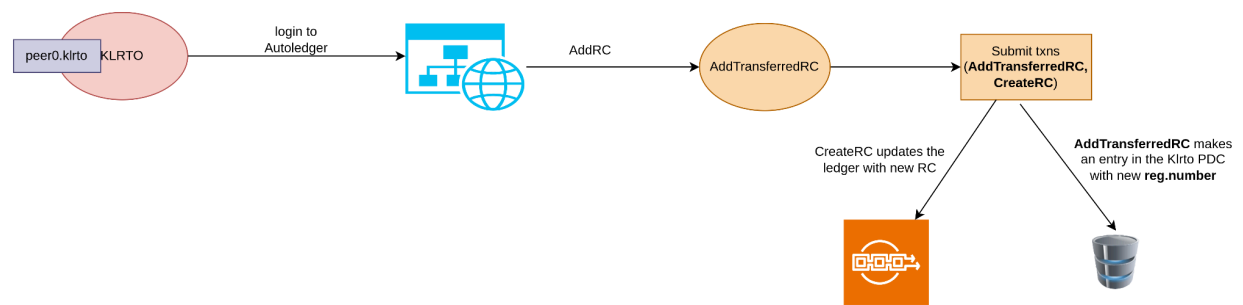
Approve Transfer RC request



Delete RC



Add Transferred RC



Running the Application

Please follow the below steps to run the application locally

Clone the repo

Git clone <https://github.com/KBA-Learning/chf-vb14-project-shreevnr.git>

Github_token : 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

Kindly follow the readme.MD to run the application

Network Setup

```
vaahan.com/msp --tls.certfiles /home/srinathi/KBA/automobile/AutoLedger/organizations/fabric-ca/knrto/ca-cert.pem
024/08/18 21:36:00 [INFO] TLS Enabled
024/08/18 21:36:00 [INFO] generating key: &[A:ecdsa S:256]
024/08/18 21:36:00 [INFO] encoded CSR
024/08/18 21:36:00 [INFO] Stored client certificate at /home/srinathi/KBA/automobile/AutoLedger/organizations/peerOrganizations/knrto.vaahan.com/users/AdmIn@knrto.vaahan.com/msp/signcerts/cert.pem
024/08/18 21:36:00 [INFO] Stored root CA certificate at /home/srinathi/KBA/automobile/AutoLedger/organizations/peerOrganizations/knrto.vaahan.com/users/AdmIn@knrto.vaahan.com/msp/cacerts/localhost-11054-
knrto.pem
024/08/18 21:36:00 [INFO] Stored Issuer public key at /home/srinathi/KBA/automobile/AutoLedger/organizations/peerOrganizations/knrto.vaahan.com/users/AdmIn@knrto.vaahan.com/msp/IssuerPublicKey
024/08/18 21:36:00 [INFO] Stored Issuer revocation public key at /home/srinathi/KBA/automobile/AutoLedger/organizations/peerOrganizations/knrto.vaahan.com/users/AdmIn@knrto.vaahan.com/msp/IssuerRevocati
nPublicKey
Rolling the CA admin
fabric-ca-client enroll -u https://admin:adminpw@localhost:9054 --caname ca-orderer --tls.certfiles /home/srinathi/KBA/automobile/AutoLedger/organizations/fabric-ca/ordererOrg/ca-cert.pem
024/08/18 21:36:00 [INFO] Created a default configuration file at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/fabric-ca-client-config.yaml
024/08/18 21:36:00 [INFO] TLS Enabled
024/08/18 21:36:00 [INFO] generating key: &[A:ecdsa S:256]
024/08/18 21:36:00 [INFO] encoded CSR
024/08/18 21:36:00 [INFO] Stored client certificate at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/msp/signcerts/cert.pem
024/08/18 21:36:00 [INFO] Stored root CA certificate at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/msp/cacerts/localhost-9054-ca-orderer.pem
024/08/18 21:36:00 [INFO] Stored Issuer public key at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/msp/IssuerPublicKey
024/08/18 21:36:00 [INFO] Stored Issuer revocation public key at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/msp/IssuerRevocationPublicKey
Registering orderer
fabric-ca-client register --caname ca-orderer --id.name orderer --id.secret ordererpw --id.type orderer --tls.certfiles /home/srinathi/KBA/automobile/AutoLedger/organizations/fabric-ca/ordererOrg/ca-ce
rt.pem
024/08/18 21:36:00 [INFO] Configuration file location: /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/fabric-ca-client-config.yaml
024/08/18 21:36:00 [INFO] TLS Enabled
024/08/18 21:36:00 [INFO] TLS Enabled
password: ordererpw
Registering the orderer admin
fabric-ca-client register --caname ca-orderer --id.name ordererAdmIn --id.secret ordererAdmInpw --id.type admin --tls.certfiles /home/srinathi/KBA/automobile/AutoLedger/organizations/fabric-ca/ordererO
rg/ca-cert.pem
024/08/18 21:36:01 [INFO] Configuration file location: /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/fabric-ca-client-config.yaml
024/08/18 21:36:01 [INFO] TLS Enabled
024/08/18 21:36:01 [INFO] TLS Enabled
password: ordererAdmInpw
Generating the orderer msp
fabric-ca-client enroll -u https://orderer:ordererpw@localhost:9054 --caname ca-orderer -M /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/orderers/orderer.vaahan
.com/msp --tls.certfiles /home/srinathi/KBA/automobile/AutoLedger/organizations/fabric-ca/ordererOrg/ca-cert.pem
024/08/18 21:36:01 [INFO] TLS Enabled
024/08/18 21:36:01 [INFO] generating key: &[A:ecdsa S:256]
024/08/18 21:36:01 [INFO] encoded CSR
024/08/18 21:36:01 [INFO] Stored client certificate at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/orderers/orderer.vaahan.com/msp/signcerts/cert.pem
024/08/18 21:36:01 [INFO] Stored root CA certificate at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/orderers/orderer.vaahan.com/msp/cacerts/localhost-9054-ca-o
rderer.pem
024/08/18 21:36:01 [INFO] Stored Issuer public key at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/orderers/orderer.vaahan.com/msp/IssuerPublicKey
024/08/18 21:36:01 [INFO] Stored Issuer revocation public key at /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/orderers/orderer.vaahan.com/msp/IssuerRevocationPu
bKey
Generating the orderer-tls certificates, use --csr.hosts to specify Subject Alternative Names
fabric-ca-client enroll -u https://orderer:ordererpw@localhost:9054 --caname ca-orderer -M /home/srinathi/KBA/automobile/AutoLedger/organizations/ordererOrganizations/vaahan.com/orderers/orderer.vaahan
.com/tls --enrollment.profile tls --csr.hosts orderer.vaahan.com --csr.hosts localhost --tls.certfiles /home/srinathi/KBA/automobile/AutoLedger/organizations/fabric-ca/ordererOrg/ca-cert.pem
024/08/18 21:36:01 [INFO] TLS Enabled
024/08/18 21:36:01 [INFO] generating key: &[A:ecdsa S:256]
024/08/18 21:36:01 [INFO] encoded CSR
```

Organization Infrastructure

```
-----Build the Infrastructure-----
creating volume "docker_orderer.vaahan.com" with default driver
creating volume "docker_peer0.tnrto.vaahan.com" with default driver
creating volume "docker_peer0.klrto.vaahan.com" with default driver
creating volume "docker_peer0.knrto.vaahan.com" with default driver
WARNING: Found orphan containers (ca_tnrto, ca_orderer, ca_knrto, ca_klrto) for this project. If you removed or renamed th
is flag to clean it up.
creating couchdb0          ... done
creating couchdb2          ... done
creating couchdb1          ... done
creating orderer.vaahan.com ... done
creating peer0.knrto.vaahan.com ... done
creating peer0.tnrto.vaahan.com ... done
creating peer0.klrto.vaahan.com ... done
creating cli               ... done
-----Generate the genesis block-----
```

Creation of Genesis Block

```
-----Generate the genesis block-----
2024-08-18 21:36:09.938 IST 0001 INFO [common.tools.configtxgen] main -> Loading configuration
2024-08-18 21:36:09.948 IST 0002 INFO [common.tools.configtxgen.localconfig] completeInitialization -> orderer type: etcdraft
2024-08-18 21:36:09.948 IST 0003 INFO [common.tools.configtxgen.localconfig] completeInitialization -> Orderer.EtcdRaft.Options unset, setting to tick_interval:'500ms' election_tick:10 heartbeat_tick:1 m
ex inflight blocks:5 snapshot_interval size:16777216
2024-08-18 21:36:09.959 IST 0004 INFO [common.tools.configtxgen.localconfig] Load -> Loaded configuration: config/configtx.yaml
2024-08-18 21:36:09.959 IST 0005 INFO [common.tools.configtxgen] doOutputBlock -> Generating genesis block
2024-08-18 21:36:09.959 IST 0006 INFO [common.tools.configtxgen] doOutputBlock -> Creating application channel genesis block
2024-08-18 21:36:09.959 IST 0007 INFO [common.tools.configtxgen] doOutputBlock -> Writing genesis block
----- Create the application channel-----
Status: 201
{
  "name": "vaahanchannel",
  "url": "/participation/v1/channels/vaahanchannel",
  "consensusRelation": "consenter",
  "status": "active",
  "height": 1
}
Status: 200
{
  "systemChannel": null,
  "channels": [
    {
      "name": "vaahanchannel",
      "url": "/participation/v1/channels/vaahanchannel"
    }
  ]
}
-----Join trnto peer to the channel-----
/home/srinath/K8A/autonobile/autolegger/peer.cfg
```

Joining peers to channel

Peers get added to the channel

Anchor peer update in each channel

Package Chaincode

Install and Approve Chaincode

CommitChaincode

Submit Transactions

Organisation1 - TNRTO (tnrto)

```
-----Join trnto peer to the channel-----
/home/srinath/K8A/autonobile/autolegger/peer.cfg
2024-08-18 21:36:20.146 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:36:20.298 IST 0002 INFO [channelCmd] executeJoin -> Successfully submitted proposal to join channel
-----tnrto anchor peer update-----
2024-08-18 21:36:23.398 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:36:23.401 IST 0002 INFO [cli.common] readBlock -> Received block: 0
2024-08-18 21:36:23.401 IST 0003 INFO [channelCmd] fetch -> Retrieving last config block: 0
2024-08-18 21:36:23.403 IST 0004 INFO [cli.common] readBlock -> Received block: 0
2024-08-18 21:36:24.839 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:36:24.858 IST 0002 INFO [channelCmd] update -> Successfully submitted channel update
-----package chaincode-----
2024-08-18 21:36:47.745 IST 0001 INFO [cli.lifecycle.chaincode] submitInstallProposal -> Installed remotely: response=<status:200 payload:"\n0autolegger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9882f9ef7c062c782187\022\016autolegger_1.0" >
2024-08-18 21:36:47.745 IST 0002 INFO [cli.lifecycle.chaincode] submitInstallProposal -> Chaincode code package identifier: autolegger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9882f9ef7c062c782187, Label: autolegger_1.0
Installed chaincodes on peer:
package ID: autolegger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9882f9ef7c062c782187, Label: autolegger_1.0
-----Approve chaincode in trnto peer-----
2024-08-18 21:36:54.188 IST 0001 INFO [chaincodeCmd] ClientWait -> txid [9d957629cdaca9b973c11df18a32129f0aa083f6393794a50282a78c3e91e8cf] committed with status (VALID) at localhost:7051
-----KLRTO-----
-----Join trnto peer to the channel-----
```

Organisation2 - KLRTO (klrto)


```

-----Join klrto peer to the channel-----
2024-08-18 21:36:56.274 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:36:56.433 IST 0002 INFO [channelCmd] executeJoin -> Successfully submitted proposal to join channel
2024-08-18 21:36:57.531 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
Channels peers has joined:
vaahanchannel
-----KLRTO anchor peer update-----
2024-08-18 21:36:57.625 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:36:57.632 IST 0002 INFO [cli.common] readBlock -> Received block: 2
2024-08-18 21:36:57.632 IST 0003 INFO [channelCmd] Fetch -> Retrieving last config block: 1
2024-08-18 21:36:57.635 IST 0004 INFO [cli.common] readBlock -> Received block: 1
2024-08-18 21:36:59.094 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:36:59.124 IST 0002 INFO [channelCmd] update -> Successfully submitted channel update
-----Install chaincode in KLRTO peer-----
2024-08-18 21:37:23.315 IST 0001 INFO [cli.lifecycle.chaincode] submitInstallProposal -> Installed remotely: response:<status:200 payload:"\n0autoledger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9082f9ef7c062c782187f022f016autoledger_1.0" >
2024-08-18 21:37:23.315 IST 0002 INFO [cli.lifecycle.chaincode] submitInstallProposal -> Chaincode code package identifier: autoledger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9082f9ef7c062c782187f022f016autoledger_1.0
Installed chaincodes on peer:
Package ID: autoledger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9082f9ef7c062c782187, Label: autoledger_1.0
-----Approve chaincode in KLRTO peer-----
2024-08-18 21:37:28.656 IST 0001 INFO [chaincodeCmd] ClientWait -> txid [feb99c4b38dc1bd4e084df30a9ce5867b4bb008c525989e6f1cba085dd100a] committed with status (VALID) at localhost:9051

```

Organisation3 - KNRT0 (knrto)

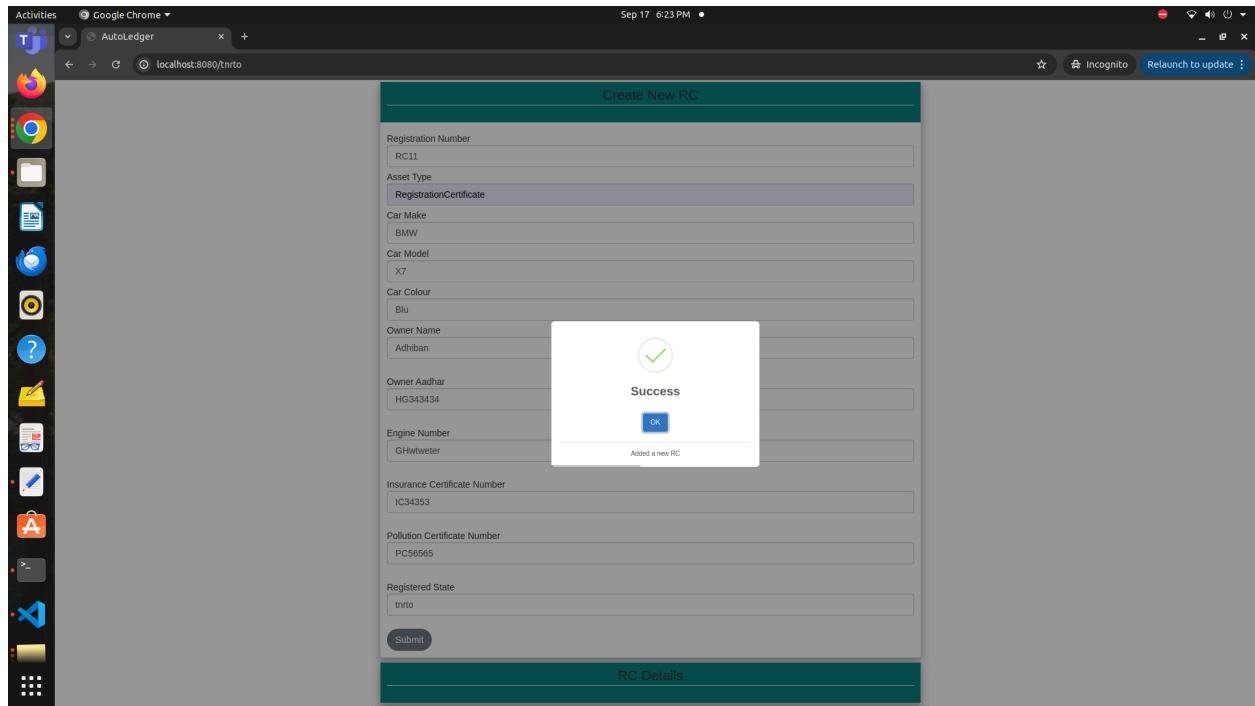
```

-----Join KNRT0 peer to the channel-----
2024-08-18 21:37:29.766 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:37:29.934 IST 0002 INFO [channelCmd] executeJoin -> Successfully submitted proposal to join channel
2024-08-18 21:37:31.037 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
Channels peers has joined:
vaahanchannel
-----KNRT0 anchor peer update-----
2024-08-18 21:37:31.107 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:37:31.108 IST 0002 INFO [cli.common] readBlock -> Received block: 4
2024-08-18 21:37:31.108 IST 0003 INFO [channelCmd] Fetch -> Retrieving last config block: 3
2024-08-18 21:37:31.109 IST 0004 INFO [cli.common] readBlock -> Received block: 3
2024-08-18 21:37:32.530 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
2024-08-18 21:37:32.546 IST 0002 INFO [channelCmd] update -> Successfully submitted channel update
2024-08-18 21:37:33.654 IST 0001 INFO [channelCmd] InitCmdFactory -> Endorser and orderer connections initialized
Blockchain info: {"height":6,"currentBlockHash":"ynFD49BrKp3rMHAp1M4Trn6cJXWVQUCyYKS7LSpIqg8","previousBlockHash":"HVZGwewun+qpZ06wqRrRABweu9n4HnsqJlJXob7VBI="}
-----Install chaincode in KNRT0 peer-----
2024-08-18 21:37:56.480 IST 0001 INFO [cli.lifecycle.chaincode] submitInstallProposal -> Installed remotely: response:<status:200 payload:"\n0autoledger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9082f9ef7c062c782187f022f016autoledger_1.0" >
2024-08-18 21:37:56.480 IST 0002 INFO [cli.lifecycle.chaincode] submitInstallProposal -> Chaincode code package identifier: autoledger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9082f9ef7c062c782187f022f016autoledger_1.0
Installed chaincodes on peer:
Package ID: autoledger_1.0:70d5e1ac2540eb2535a31fc1bce33bfa912f269a00cd9082f9ef7c062c782187, Label: autoledger_1.0
-----Approve chaincode in KNRT0 peer-----
2024-08-18 21:38:01.872 IST 0001 INFO [chaincodeCmd] ClientWait -> txid [9797f524140f95bcb5a369549a2b9acc4d8629b25bce45ae5dba1171c7527c88] committed with status (VALID) at localhost:11051
-----Commit chaincode in KNRT0 peer-----
{
  "approvals": {
    "klrtoMSP": true,
    "knrtoMSP": true,
    "tnrtoMSP": true
  }
}
2024-08-18 21:38:04.225 IST 0001 INFO [chaincodeCmd] ClientWait -> txid [53a17ec5078e2b7d452b5f12b1a952fdScadC84caec54f3538e646bfc0775f02] committed with status (VALID) at localhost:11051
2024-08-18 21:38:04.235 IST 0002 INFO [chaincodeCmd] ClientWait -> txid [53a17ec5078e2b7d452b5f12b1a952fdScadC84caec54f3538e646bfc0775f02] committed with status (VALID) at localhost:7051
2024-08-18 21:38:04.267 IST 0003 INFO [chaincodeCmd] ClientWait -> txid [53a17ec5078e2b7d452b5f12b1a952fdScadC84caec54f3538e646bfc0775f02] committed with status (VALID) at localhost:9051
Committed chaincode definition for chaincode 'autoledger' on channel 'vaahanchannel':
Version: 1.0, Sequence: 1, Endorsement Plugin: escc, Validation Plugin: vscc, Approvals: {klrtoMSP: true, knrtoMSP: true, tnrtoMSP: true}

```

Submit Transactions

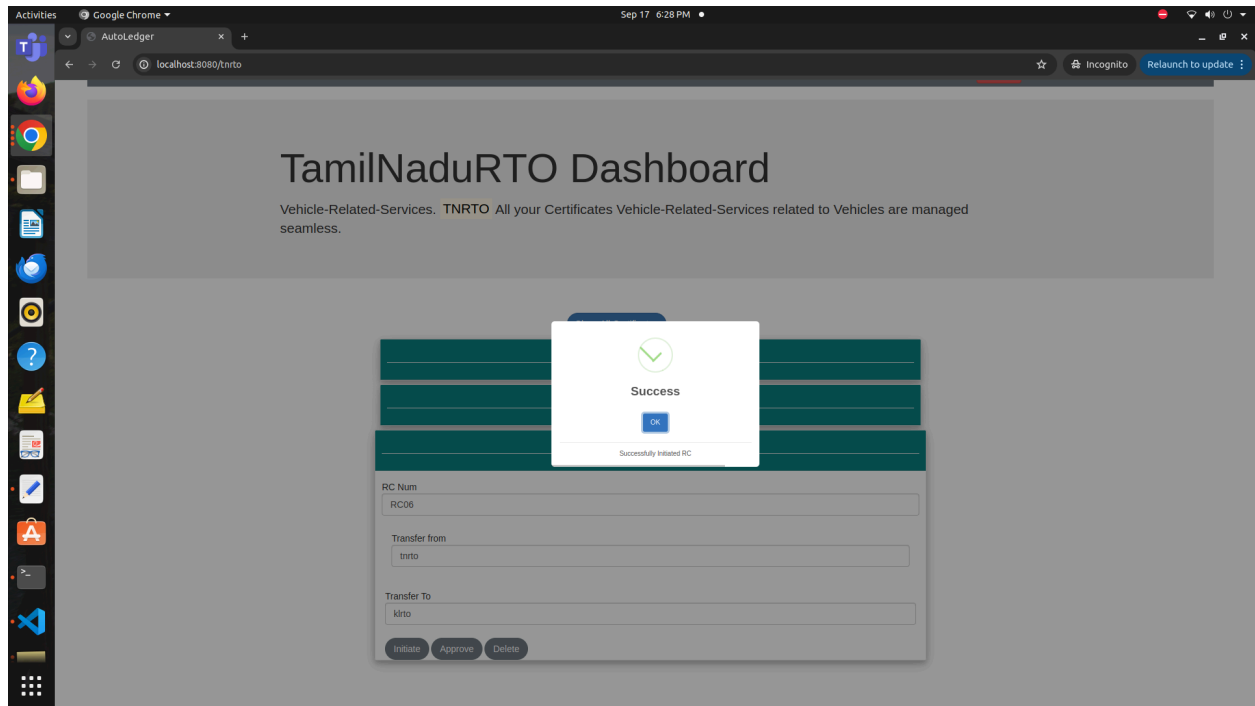
Invoke- CreateRegistration Certificate



```
[GIN] 2024/09/17 - 18:22:56 | 500 | 21.116441ms | 127.0.0.1 | POST | "/api/rc/create"
Registration Certificate Details {RegistrationCertificate RC11 BMW X7 Blu Adhiban HG343434 GHwtweter IC34353 PC56565 tnrto}Registration Certificate Details: map[rc_properties:{"assetType":"Registration
Certificate","rcId":"RC11","make":"BMW","model":"X7","color":"Blu","ownerName":"Adhiban","ownerAadhar":"HG343434","engineNumber":"GHwtweter","InsuranceCert":"IC34353","pollutionCert":"PC56565","status":"
","registeredState":"tnrto"}]

-->Submitting Transaction: CreateRC,
-->Transaction Type: private,
Received chaincode event CreateRC
```

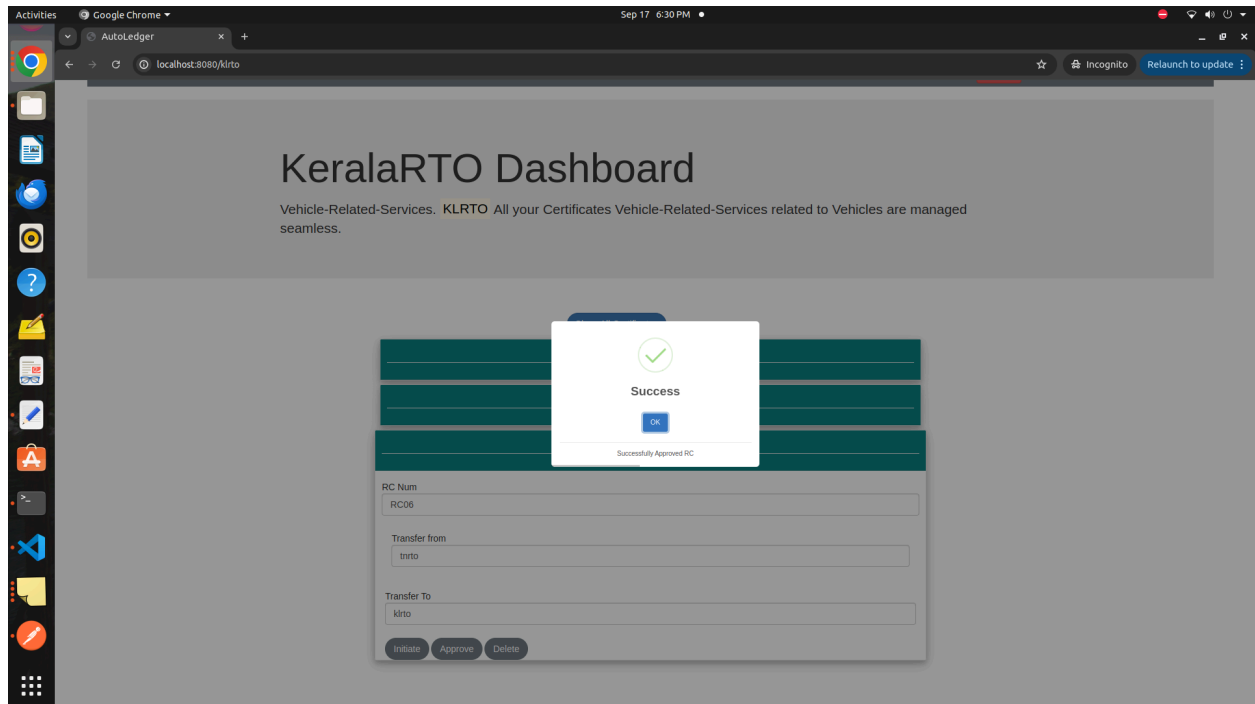
Invoke - InitiateRCTransfer



```
[GIN] 2024/09/17 - 18:27:40 | 200 | 22.031449ms | 127.0.0.1 | GET | "/tnrto"
Inside Initiate transferInitiate RC Transfer {RC06 tnrto klrto}
-->Submitting Transaction: InitiateTransferRC,

-->Transaction Type: invoke,
[GIN] 2024/09/17 - 18:28:33 | 200 | 2.075143306s | 127.0.0.1 | POST | "/api/rc/initiateTransfer"
-->Submitting Transaction: GetAllRCs,
```

Invoke - ApproveRCTransfer



```
->Transaction Type: query,  
[GIN] 2024/09/17 - 18:30:35 | 200 | 22.416904ms | 127.0.0.1 | GET | "/klrto"  
Approve RC Transfer {RC06 tnrto klrto}  
-->Submitting Transaction: ApproveTransferRC,  
  
-->Transaction Type: invoke,  
[GIN] 2024/09/17 - 18:30:51 | 200 | 2.09412852s | 127.0.0.1 | POST | "/api/rc/approveTransfer"
```

Invoke - DeleteRC

```
->Transaction Type: query,  
[GIN] 2024/09/17 - 18:34:44 | 200 | 21.276626ms | 127.0.0.1 | GET | "/tnrto"  
Delete RC {RC06 tnrto klrto}  
-->Submitting Transaction: DeleteRC,  
  
-->Transaction Type: invoke,  
[GIN] 2024/09/17 - 18:35:07 | 200 | 2.102522759s | 127.0.0.1 | POST | "/api/rc/deleterc"
```

Activities Google Chrome Sep 17 6:37 PM

AutoLedger

localhost:8080/ap/tnrto/rc/all

Back to dashboard Logout

All RCs registered with TNRTO

RC Id	AssetType	Make	Model	Color	Owner Name	Owner Aadhar	Engine Number	Insurance Certificate	Pollution Certificate	Registered State	Status
RC01	RegistrationCertificate	MG	hector	blue	Srmathi	AD1221	EN212	IC212	PC3231	tnrto	Active Get history
RC05	RegistrationCertificate	MG	hector	blue	Vadhana	AD1221	EN212	IC212	PC3231	tnrto	Active Get history
RC07	RegistrationCertificate	Toyota	Innova	Black	Aadhavan	AD1212121	EN12121	IC12121221	PC1212121	tnrto	Active Get history
RC08	RegistrationCertificate	Tata	Nixon	Blue	Vivel	AD232323	EN4343	IC343434	PC343434	tnrto	Active Get history
RC09	RegistrationCertificate	Kia	Seltos	Black	Rithvik	ADJKKK	EN324242	IC3434	PC3434343	tnrto	Active Get history
RC11	RegistrationCertificate	BMW	X7	Blu	Adhiban	HG343434	GHwtweter	IC34353	PC56565	tnrto	Active Get history

RC06 deleted from private data collection tnrtoPDC
RC06 deleted from ledger

localhost:8080

AutoLedger App Login

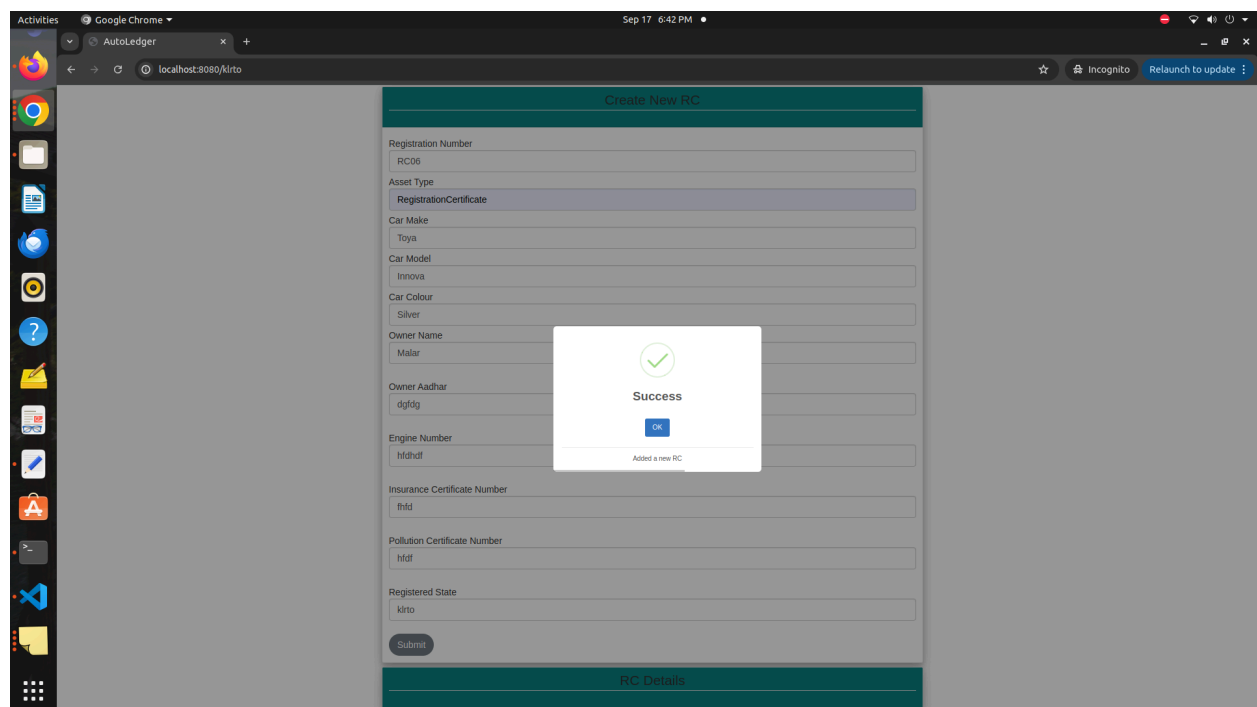
AutoLedger

autoLedger is a cutting-edge blockchain solution designed for transparent and secure management of vehicle registration certificates. With autoLedger, you can trust that each transaction—from issuing to transferring a vehicle's Registration Certificate (RC)—is recorded immutably on a decentralized ledger, ensuring accountability and authenticity. Currently **TamilNadu , Kerala and Karnataka** towards a common goal of achieving immutability, transparency and privacy on the automobile industry

Complete RC List

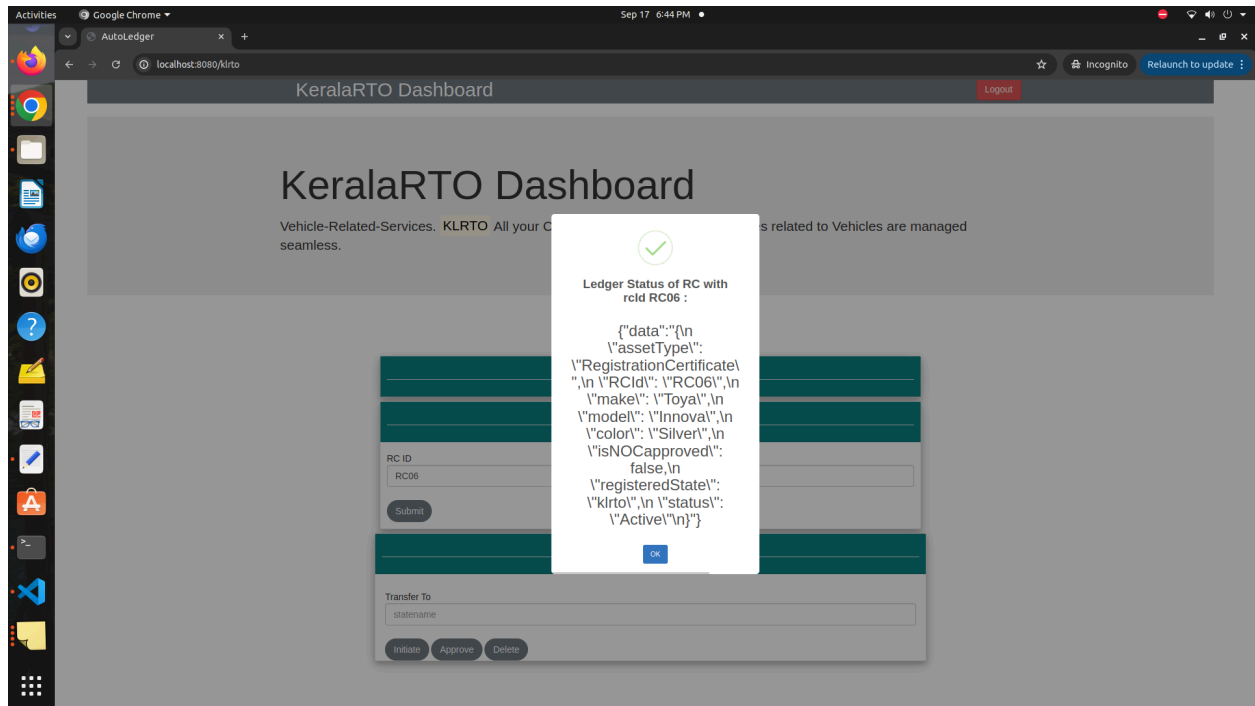
RCId	AssetType	Color	Make	Model	IsNOCApproved	Status	RegisteredState
RC11	RegistrationCertificate	Blu	BMW	X7	true	Transfer Initiated	tnrto Get history
RC09	RegistrationCertificate	Black	Kia	Seltos	false	Active	tnrto Get history
RC08	RegistrationCertificate	Blue	Tata	Nixon	false	Active	tnrto Get history
RC07	RegistrationCertificate	Black	Toyota	Innova	true	Transfer Approved	tnrto Get history
RC05	RegistrationCertificate	blue	MG	hector	false	Active	tnrto Get history
RC01	RegistrationCertificate	blue	MG	hector	false	Active	tnrto Get history

Invoke - AddTransferredRC

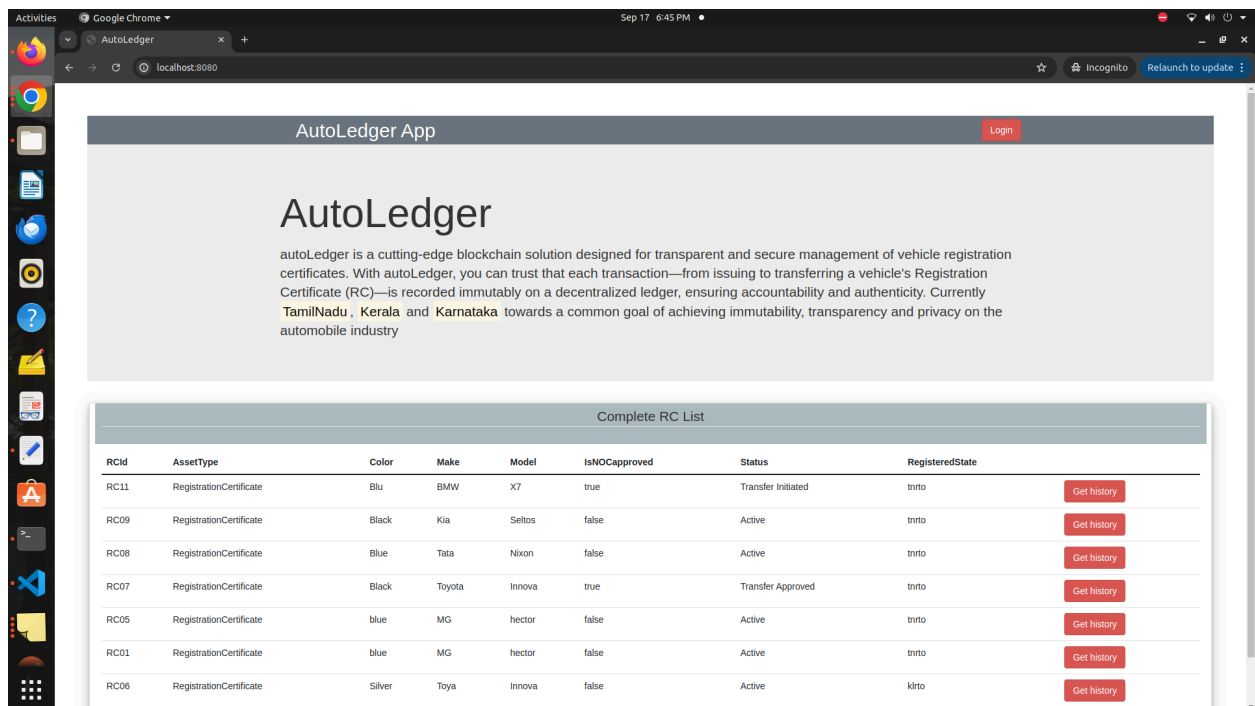


RC History									
Asset Type	RC ID	Make	Model	Color	isNOCApproved	RegisteredState	Status	TimeStamp	IsDelete
RegistrationCertificate	RC06	Toya	Innova	Silver	false	klrto	Active	Tue, 17 Sep 2024 13:11:52 UTC	false
	RC06				false			Tue, 17 Sep 2024 13:05:05 UTC	true
RegistrationCertificate	RC06	Toyato	Innove	Silver	true	tnrto	Transfer Approved	Tue, 17 Sep 2024 13:00:49 UTC	false
RegistrationCertificate	RC06	Toyato	Innove	Silver	true	tnrto	Transfer Initiated	Tue, 17 Sep 2024 12:58:31 UTC	false
RegistrationCertificate	RC06	Toyato	Innove	Silver	false	tnrto	Active	Tue, 17 Sep 2024 12:27:09 UTC	false

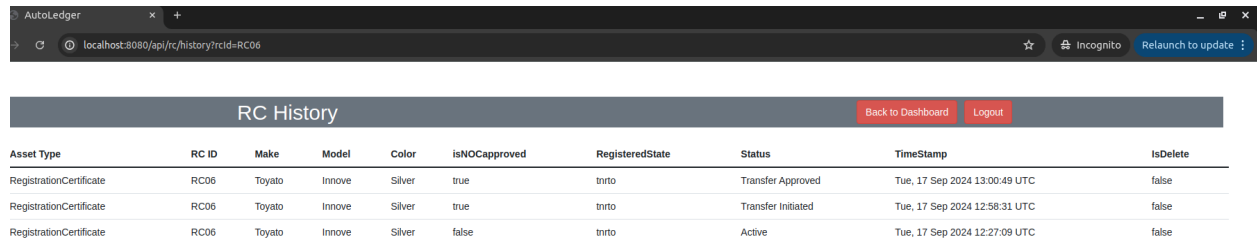
Query - GetAssetDetails



Query - GetAllRCs



Query - GetAssethistory



RC History									
Asset Type	RC ID	Make	Model	Color	isNOCAppeared	RegisteredState	Status	TimeStamp	IsDelete
RegistrationCertificate	RC06	Toyota	Innove	Silver	true	tnrto	Transfer Approved	Tue, 17 Sep 2024 13:00:49 UTC	false
RegistrationCertificate	RC06	Toyota	Innove	Silver	true	tnrto	Transfer Initiated	Tue, 17 Sep 2024 12:58:31 UTC	false
RegistrationCertificate	RC06	Toyota	Innove	Silver	false	tnrto	Active	Tue, 17 Sep 2024 12:27:09 UTC	false

```
->Transaction Type: query,  
GIN] 2024/09/17 - 18:32:31 | 200 | 26.452046ms | 127.0.0.1 | GET | "/api/tnrto/rc/all"  
  
->Submitting Transaction: GetAssetHistory,  
  
->Transaction Type: query,  
GIN] 2024/09/17 - 18:32:37 | 200 | 16.315145ms | 127.0.0.1 | GET | "/api/rc/history?rcId=RC06"
```

ChainCode Functions

CreateRC - Creates an entry for new RegistrationCertificate in the Ledger

CreatePrivateRC - Creates a new registration certificate and an entry will be made in the requesting state's PDC

AddRC - Fetch the RC details from the “**TransferRCCollection**” (**the RC status has to be dis-owned by the state that initiated the transfer**) and Adds it to the new state with new RCID.

InitiateRCTransfer - A state Initiates the Registration Certificate transfer and update the status of the RC.

approveRCTransfer -A state approves the Registration Certificate transfer if the noc is approved and update the status in ledger

deleteRC - A state deletes an RC entry in the organization's PDC if the transfer is Approved by approving state and .Before deleting the RC entry will be moved to TransferRCCollection.

GetAllRCs - Will fetch all the registration certificates

GetAssetDetails - will fetch on-chain detail of a given RC ID

GetAssetPrivateDetails - Will fetch Asset details from PDC

GetAssetHistory - will fetch the history details of give RC

GetAssetsbyRange - will fetch the Asset details of given range

GetAssetsWithPagination - Will fetch the results with pagination by performing rich query on the ledger

Client and API Implementation

Following APIs are implemented in AutoLedger

S.No	Endpoint	Purpose	function
1	GET:/	Index page for AutoLedger	<code>GetAllRCs</code>
2	GET:/tnrto	Index page for tnrto Org1	
3	GET:/klrto	Index page for klrto Org2	
4	POST:/api/rc/create	To create Registration Certificate	<code>CreatePrivateRC</code> <code>CreateRC</code>
5	POST:/api/rc/initiateTransfer	To initiate transfer RC done by initiating state	<code>InitiateTransferRC</code>
6	POST:/api/rc/approveTransfer	To approve transfer RC done by approving state	<code>ApproveTransferRC</code>
7	POST:/api/rc/deleterc	To delete transferred RC done by initiating state	<code>MovetoTransferRC</code> <code>Collection</code> <code>DeleteRC</code>
8	POST:/api/rc/addrc	To add transferred RC done by approving state	<code>AddTransferredRC</code> <code>CreateRC</code>

9	GET:/api/tnrto/rc/all	To list of all the RCs from tnrto PDC	GetAssetCollection
10	GET:/api/klrto/rc/all	To list out all the RCs from klrto PDC	GetAssetCollection
11	GET:/api/tnrto/transferred_rc/all	To list out all the Transferred RCs from tnrto page	GetTransferredRCCollection
12	GET:/api/klrto/transferred_rc/all	To list out all the Transferred RCs from klrto page	GetTransferredRCCollection
13	GET:/api/tnrto/rc/:id	To get the on-chain detail of a given RC by tnrto	GetAssetDetails
14	GET:/api/klrto/rc/:id	To get the on-chain detail of a given RC by klrto	GetAssetDetails
15	GET:/api/rc/history	To get the History of the give RC	GetAssetHistory
16	GET:/api/rc/asset_by_range	To get the assets by given range	GetAssetsByRange
17	GET:/api/rc/asset_with_pagination	To get the assets with pagination	GetAssetsWithPagination

Conclusion

The AutoLedger project successfully demonstrates the application of Hyperledger Fabric in creating a secure, scalable, and efficient blockchain-based system for managing vehicle registration certificates (RCs) across multiple states. By leveraging the Private Data Collection (PDC) feature, the solution ensures that sensitive information is shared and maintained by respective states while maintaining the integrity and confidentiality of the data.

The workflow for the transfer, including the creation, approval, deletion, and re-registration of RCs, is streamlined and auditable, providing transparency and accountability in the process.