Practical 5

Blockchain Technology

2CSDE93

Dhruv Sonani

20BCE527

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Department of Computer Science and Engineering
Institute of Technology

Nirma University

Ahmedabad

Aim: To implement a custom token like ERC_20 token of ethereum blockchain and add functionalities like burn tokens, mint new tokens and whitelist a address(whitelisting allows the contract to transfer tokens only if address is whitelisted by Owner).

Code

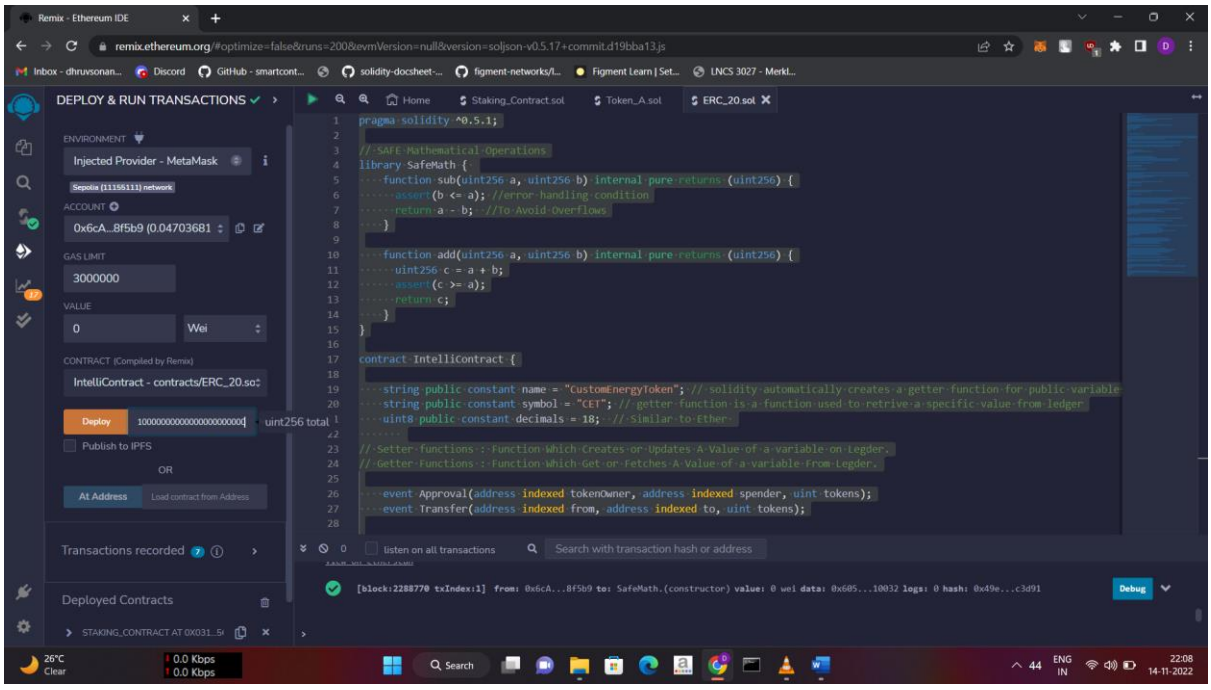
```
pragma solidity ^0.5.1;

// SAFE Mathematical Operations
library SafeMath {
    function sub(uint256 a, uint256 b) internal pure returns (uint256) {
      assert(b <= a); //error handling condition
      return a - b;  //To Avoid Overflows
    }

    function add(uint256 a, uint256 b) internal pure returns (uint256) {
      uint256 c = a + b;
      assert(c >= a);
      return c;
    }
}

contract IntelliContract {

    string public constant name = "CustomEnergyToken"; // solidity
automatically creates a getter function for public variables
    string public constant symbol = "CET"; // getter function is a function
used to retrive a specific value from ledger
    uint8 public constant decimals = 18;  // Similar to Ether

// Setter functions : Function Which Creates or Updates A Value of a variable
on Legder.
// Getter Functions : Function Which Get or Fetches A Value of a variable From
Legder.

    event Approval(address indexed tokenOwner, address indexed spender, uint
tokens);
    event Transfer(address indexed from, address indexed to, uint tokens);


    modifier onlyOwner  {
        require (msg.sender == ownerCon);
        _;
    }
```

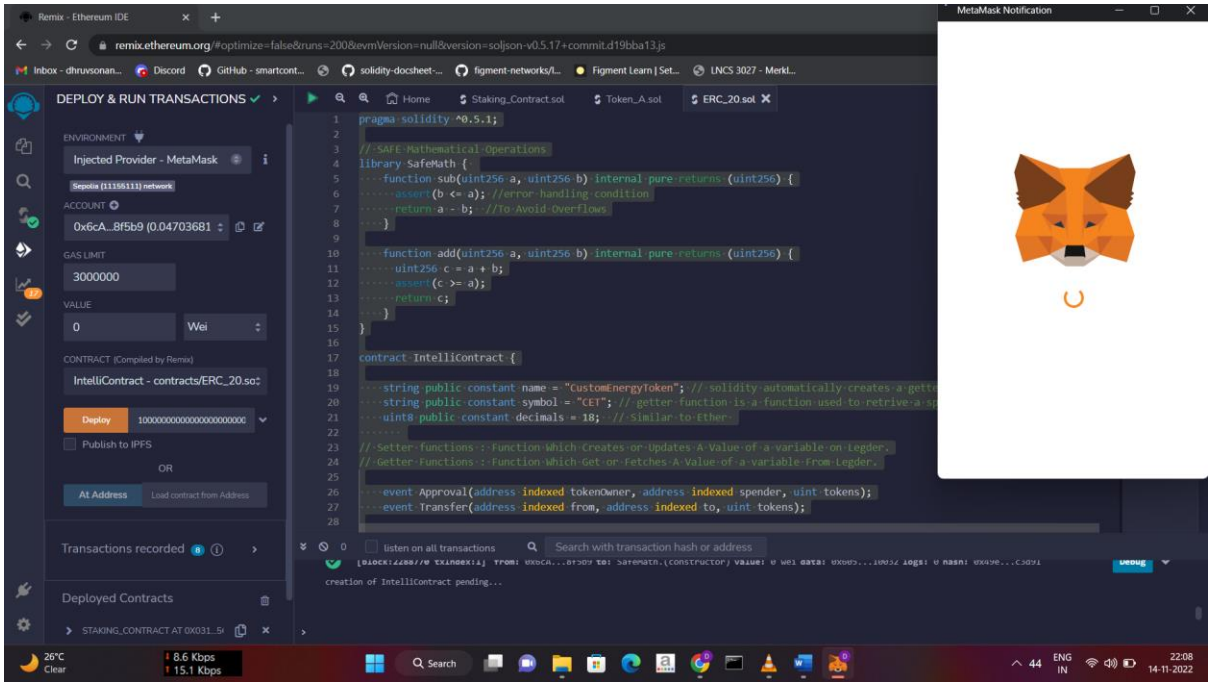
```
    mapping(address => uint256) balances;
    mapping(address => bool) whiteList_addresses;
   // ------------------------------------------------------------------------
----
    mapping(address => mapping (address => uint256)) allowed;  // nested
mapping

    // Nested Mapping Has 2 Keys & 1 Value

    uint256 totalSupply_;
    address ownerCon;

    using SafeMath for uint256;


   constructor(uint256 total) public {  // special function , only called at
time of deployemnet
    totalSupply_ = total ;
    balances[msg.sender] = total ;  // To Deposit all the newly generated
tokens in owner's account
    whiteList_addresses[msg.sender] = true;
    ownerCon = msg.sender;
    }

    function totalSupply() public view returns (uint256) {
    return totalSupply_;
    }
    // getter function



    function balanceOf(address inputAddress) public view returns (uint) {
        return balances[inputAddress];
    }
    // getter function


    function transfer(address receiver, uint numTokens) public
IsWhiteListed(receiver) returns (bool) {
        require(numTokens <= balances[msg.sender], "Not Sufficient Balance");
        balances[msg.sender] = balances[msg.sender].sub(numTokens);
        balances[receiver] = balances[receiver].add(numTokens);
        emit Transfer(msg.sender, receiver, numTokens); // logging these
values using events
        return true;
    }
```

```
    function approve(address approved_addr, uint numTokens) public returns
(bool) {
        allowed[msg.sender][approved_addr] = numTokens;
        emit Approval(msg.sender, approved_addr, numTokens);
        return true;
    }


    function allowance(address owner, address token_manger) public view
returns (uint) {
        return allowed[owner][token_manger];
    }// what allowance has been provided by token_owner to Token_manager


    //NOTE -- requires buyer address to be whitelisted address
    function transferFrom(address owner, address buyer, uint numTokens) public
returns (bool) {
        require(numTokens <= balances[owner]);
        require(numTokens <= allowed[owner][msg.sender]);
        balances[owner] = balances[owner].sub(numTokens);
        allowed[owner][msg.sender] =
allowed[owner][msg.sender].sub(numTokens);
        balances[buyer] = balances[buyer].add(numTokens);
        emit Transfer(owner, buyer, numTokens);
        return true;
    }

    function Mint_New_Tokens(uint256 numTokens)external onlyOwner{
        require(numTokens>0, "Enter the number of tokens more than 0");
        balances[msg.sender] = balances[msg.sender].add(numTokens);
        totalSupply_ = totalSupply_.add(numTokens);
        emit Transfer(address(0),msg.sender,numTokens);
    }
    //function to increase the total supply of tokens

    function burnTokens(uint256 numTokens) external onlyOwner{
        require(numTokens<=balances[msg.sender],"Not enough tokens to burn");
        require(numTokens>0, "Enter the number of tokens more than 0");
        balances[msg.sender] = balances[msg.sender].sub(numTokens);
        totalSupply_ = totalSupply_.sub(numTokens);
        emit Transfer(msg.sender,address(0),numTokens);
    }
    //function to decrease the total supply of tokens(burn tokens)

    function whiteList_A_Address(address add_To_whitelist)public onlyOwner{
        whiteList_addresses[add_To_whitelist] = true;
    }

    modifier IsAlreadyWhitelisted(address VerifyAddress){
```

```
        require(whiteList_addresses[VerifyAddress] == true, "Address is
already whitelisted");
        _;
    }

    modifier IsWhiteListed(address VerifyAddress){
        require(whiteList_addresses[VerifyAddress] == true,"Address needs to
be whitelisted");
        _;
    }
}
```

Output:




Remix - Ethereum IDE
remix.ethereum.org/#optimize=false&runs=200&evmVersion=null&version=soljson-v0.5.17+commit.d19bba13.js
DEPLOY & RUN TRANSACTIONS
ENVIRONMENT
Injected Provider - MetaMask
Sepolia (11155111) network
ACCOUNT
0x6cA...8f5b9 (0.04703681
GAS LIMIT
3000000
VALUE
0
Wei
CONTRACT (Compiled by Remix)
IntelliContract - contracts/ERC_20.so
Deploy
Publish to IPFS
OR
At Address
Load contract from Address
Transactions recorded
Deployed Contracts
Home
Staking_Contract.sol
Token_A.sol
ERC_20.sol
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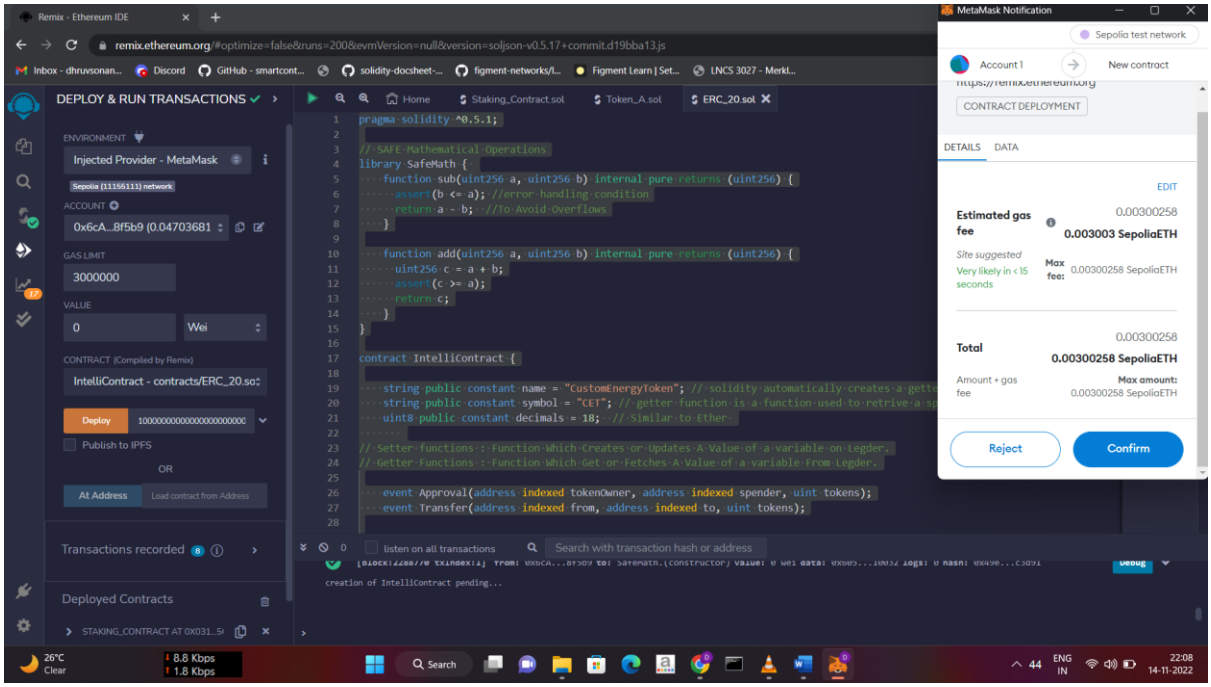
uint256 c = a + b;
assert(c >= a);
return c;
}
}
contract IntelliContract {
string public constant name = "CustomEnergyToken"; // solidity automatically creates a getter
string public constant symbol = "CET"; // getter function is a function used to retrive a
uint8 public constant decimals = 18; // Similar to Ether
//Setter functions : Function which Creates or Updates A Value of a variable on Legder.
//Getter Functions : Function which Get or Fetches A Value of a variable From Legder.
event Approval(address indexed tokenOwner, address indexed spender, uint tokens);
event Transfer(address indexed from, address indexed to, uint tokens);
listen on all transactions
Search with transaction hash or address
creation of IntelliContract pending...
MetaMask Notification
26°C
Clear
8.6 Kbps
15.1 Kbps
Search
ENG
IN
22:08
14-11-2022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Injected Provider - MetaMask
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GAS LIMIT
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Deploy
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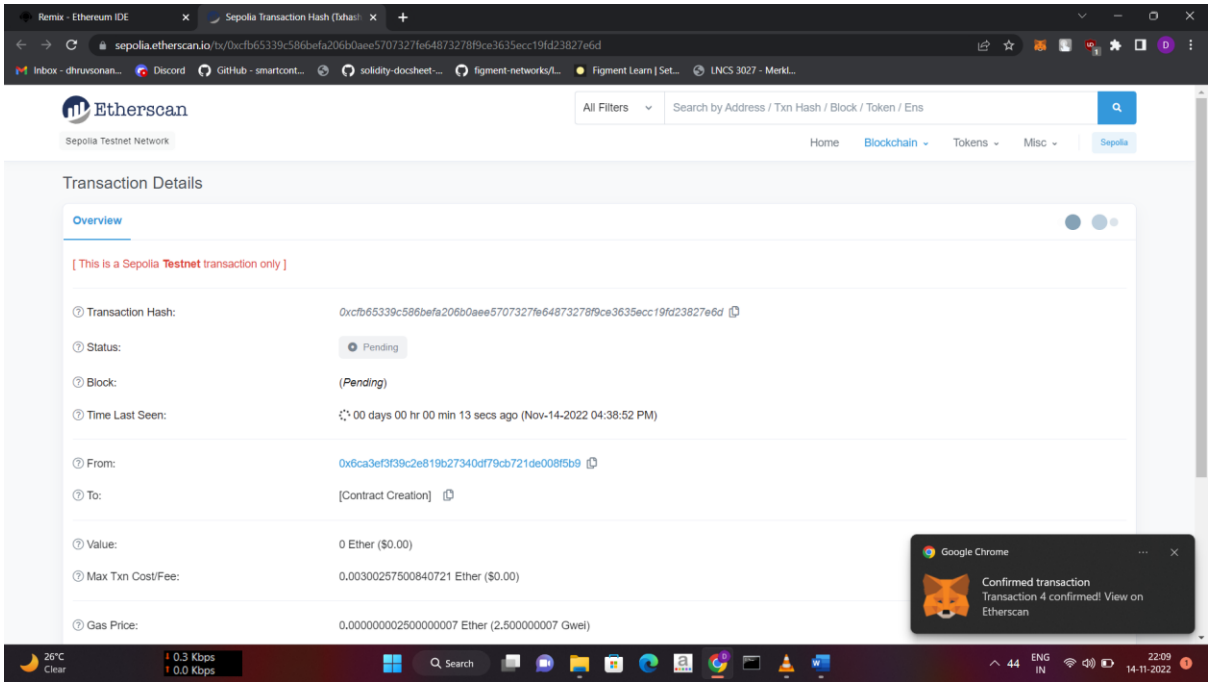
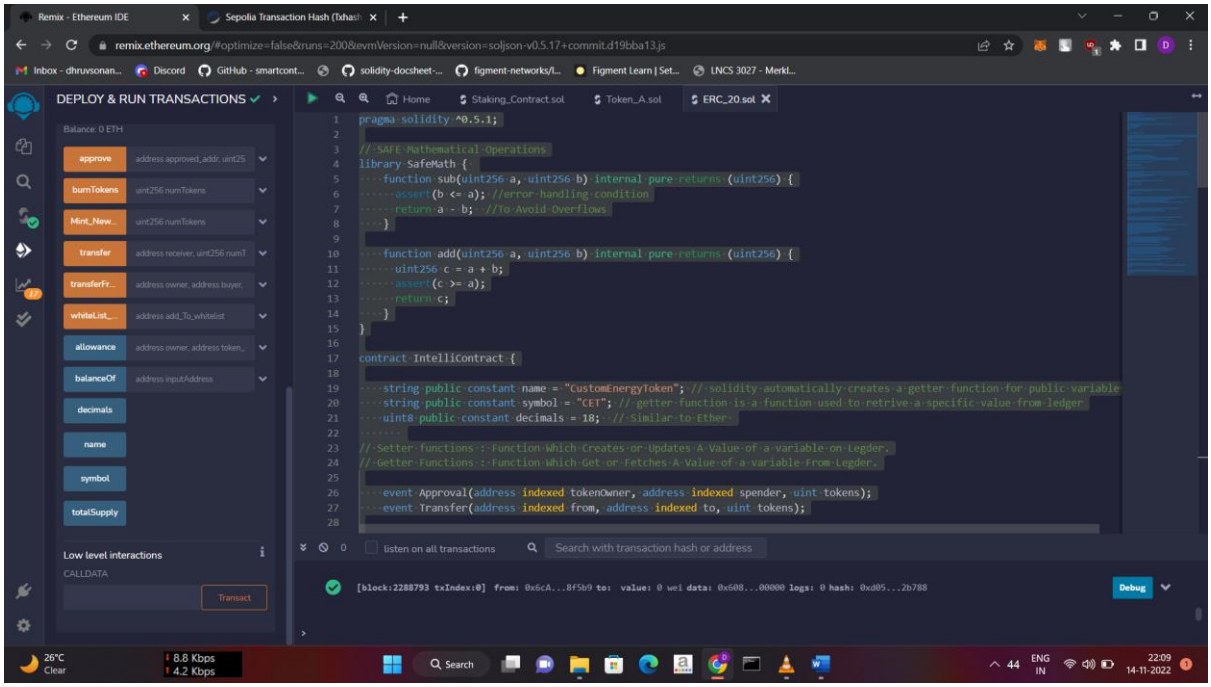
listen on all transactions
Search with transaction hash or address
creation of IntelliContract pending...
MetaMask Notification
Sepolia test network
Account 1
New contract
CONTRACT DEPLOYMENT
DETAILS
DATA
EDIT
Estimated gas fee
0.00300258
0.003003 SepoliaETH
Site suggested
Very likely in < 15 seconds
Max fee:
0.00300258 SepoliaETH
Total
0.00300258
0.00300258 SepoliaETH
Amount + gas fee
Max amount:
0.00300258 SepoliaETH
Reject
Confirm
26°C
Clear
8.8 Kbps
1.8 Kbps
Search
ENG
IN
22:08
14-11-2022


Remix - Ethereum IDE
Sepolia Transaction Hash (Txhash)
sepolia.etherscan.io/tx/0xcfb65339c586befa206b0aee5707327fe64873278f9ce3635ecc19fd23827e6d
Etherscan
Sepolia Testnet Network
All Filters
Search by Address / Txn Hash / Block / Token / Ens
Home
Blockchain
Tokens
Misc
Sepolia
Transaction Details
Overview
[This is a Sepolia Testnet transaction only]
Transaction Hash:
0xcfb65339c586befa206b0aee5707327fe64873278f9ce3635ecc19fd23827e6d
Status:
Pending
Block:
(Pending)
Time Last Seen:
00 days 00 hr 00 min 13 secs ago (Nov-14-2022 04:38:52 PM)
From:
0x6ca3ef3f39c2e819b27340df79cb721de008f5b9
To:
[Contract Creation]
Value:
0 Ether ($0.00)
Max Txn Cost/Fee:
0.00300257500840721 Ether ($0.00)
Gas Price:
0.000000002500000007 Ether (2.500000007 Gwei)
Google Chrome
Confirmed transaction
Transaction 4 confirmed! View on Etherscan
26°C
Clear
0.3 Kbps
0.0 Kbps
Search
ENG
IN
22:09
14-11-2022


Remix - Ethereum IDE
Sepolia Transaction Hash (Txhash)
remix.ethereum.org/#optimize=false&runs=200&evmVersion=null&version=soljson-v0.5.17+commit.d19bba13.js
DEPLOY & RUN TRANSACTIONS
Balance: 0 ETH
approve
burnTokens
Mint_New...
transfer
transferFr...
whiteList_...
allowance
balanceOf
decimals
name
symbol
totalSupply
Low level interactions
CALLDATA
Transact
Home
Staking_Contract.sol
Token_A.sol
ERC_20.sol
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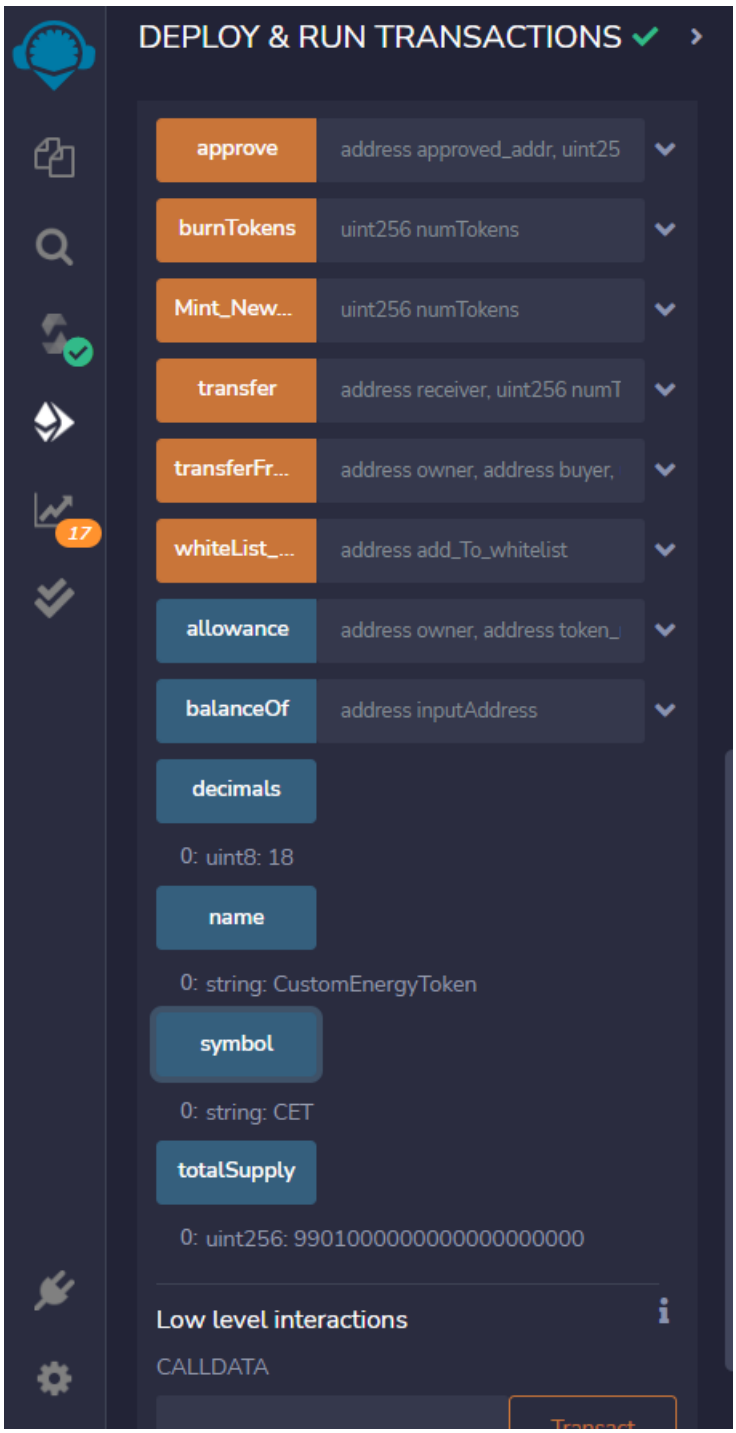
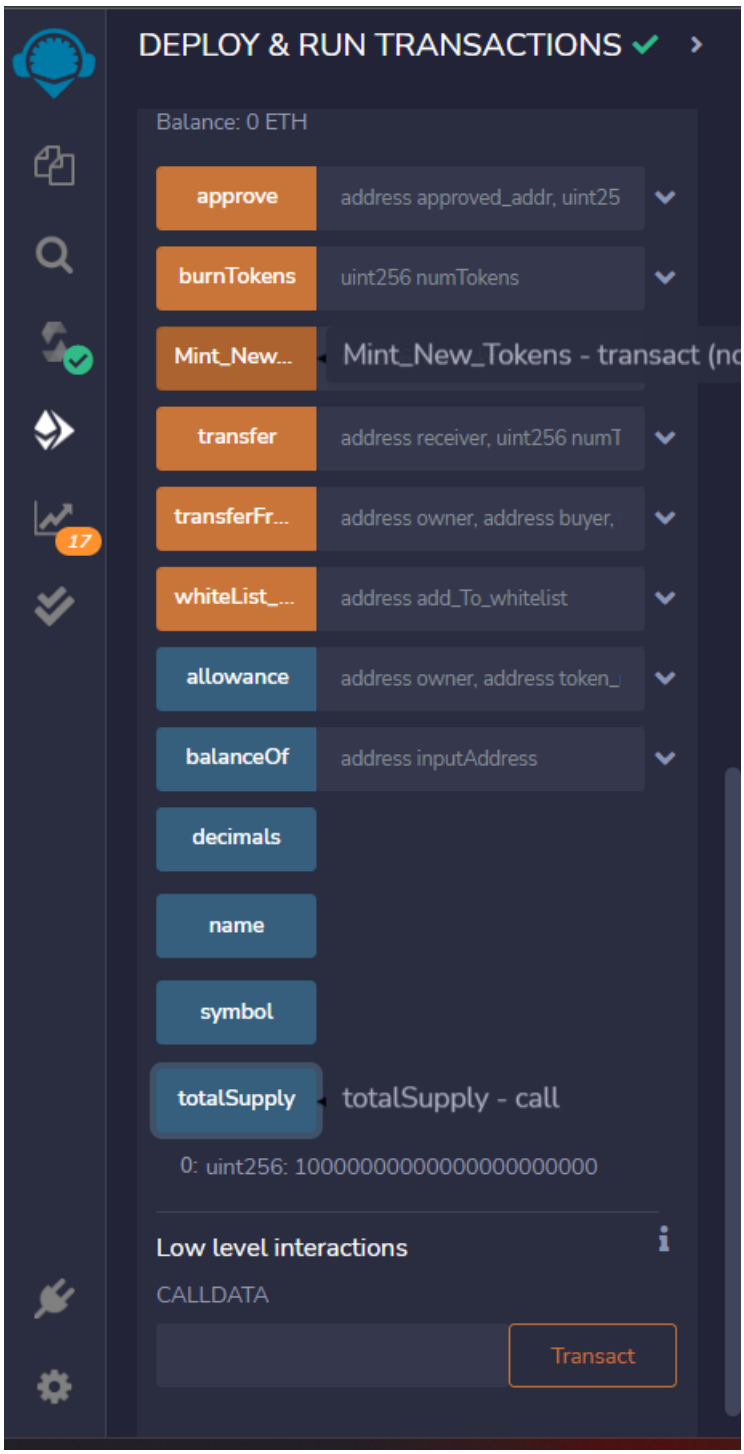
listen on all transactions
Search with transaction hash or address
Debug
26°C
Clear
8.8 Kbps
4.2 Kbps
Search
ENG
IN
22:09
14-11-2022

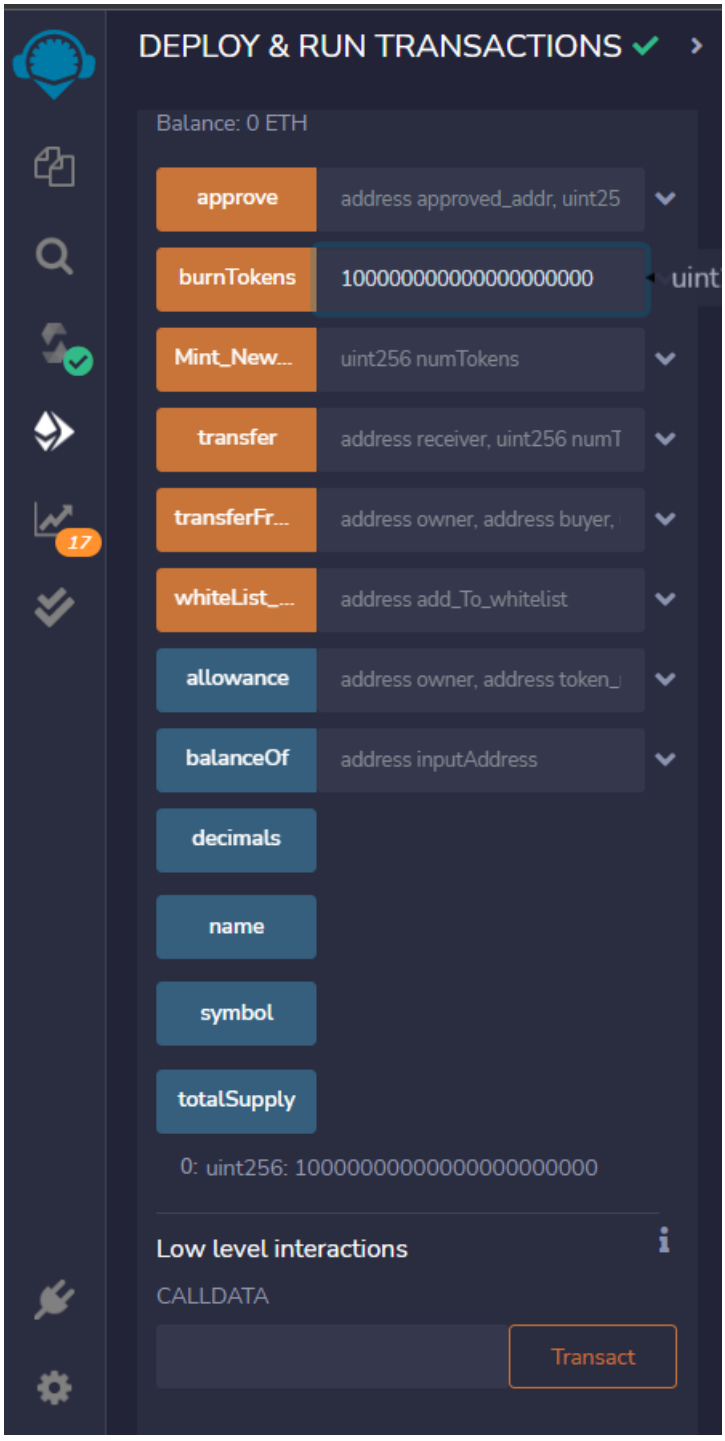
Details of the custom Token:

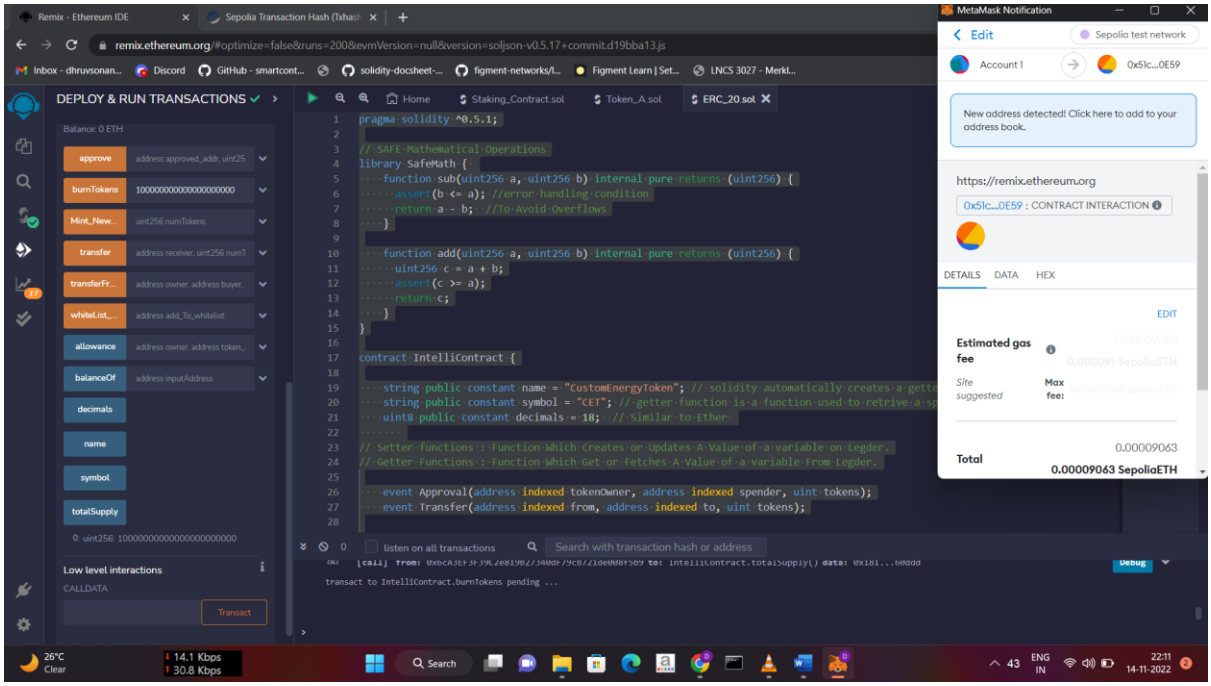


Total supply of custom token:



Burning 100 Custom Tokens:




Remix - Ethereum IDE
Sepolia Transaction Hash (Txhash)
remix.ethereum.org/#optimize=false&runs=200&evmVersion=null&version=soljson-v0.5.17+commit.d19bba13.js
DEPLOY & RUN TRANSACTIONS
Balance: 0 ETH
approve
burnTokens
Mint_New...
transfer
transferFr...
whiteList_...
allowance
balanceOf
decimals
name
symbol
totalSupply
Low level interactions
CALLDATA
Transact
Home
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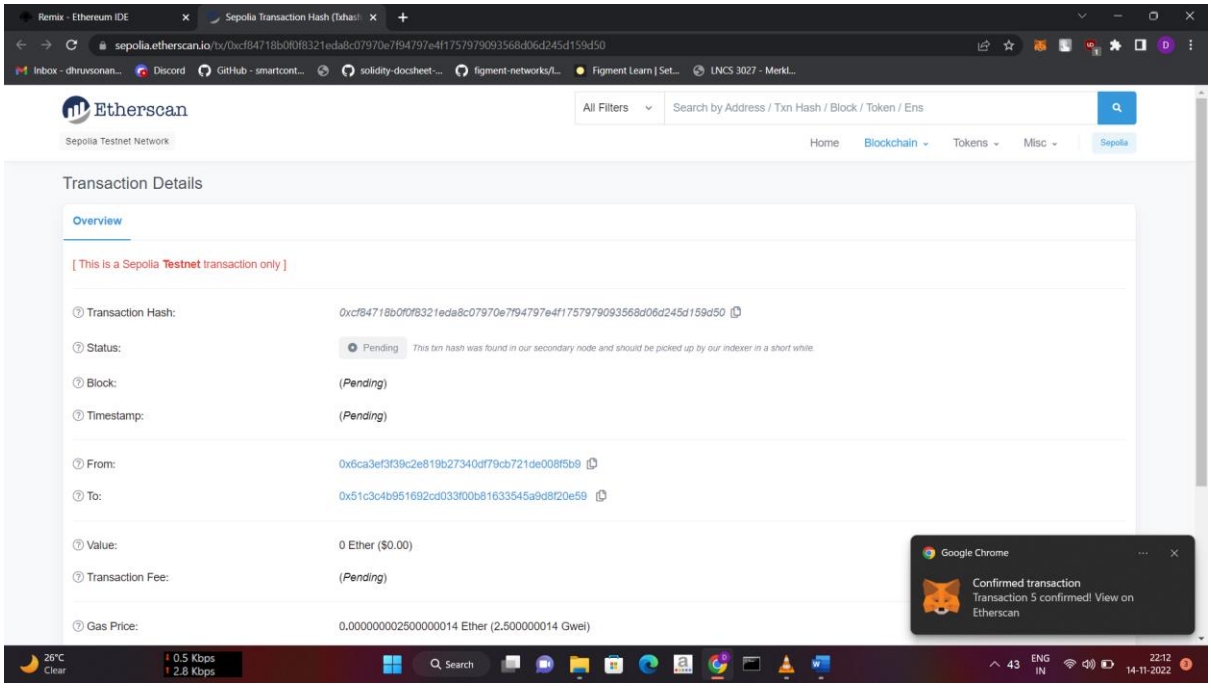
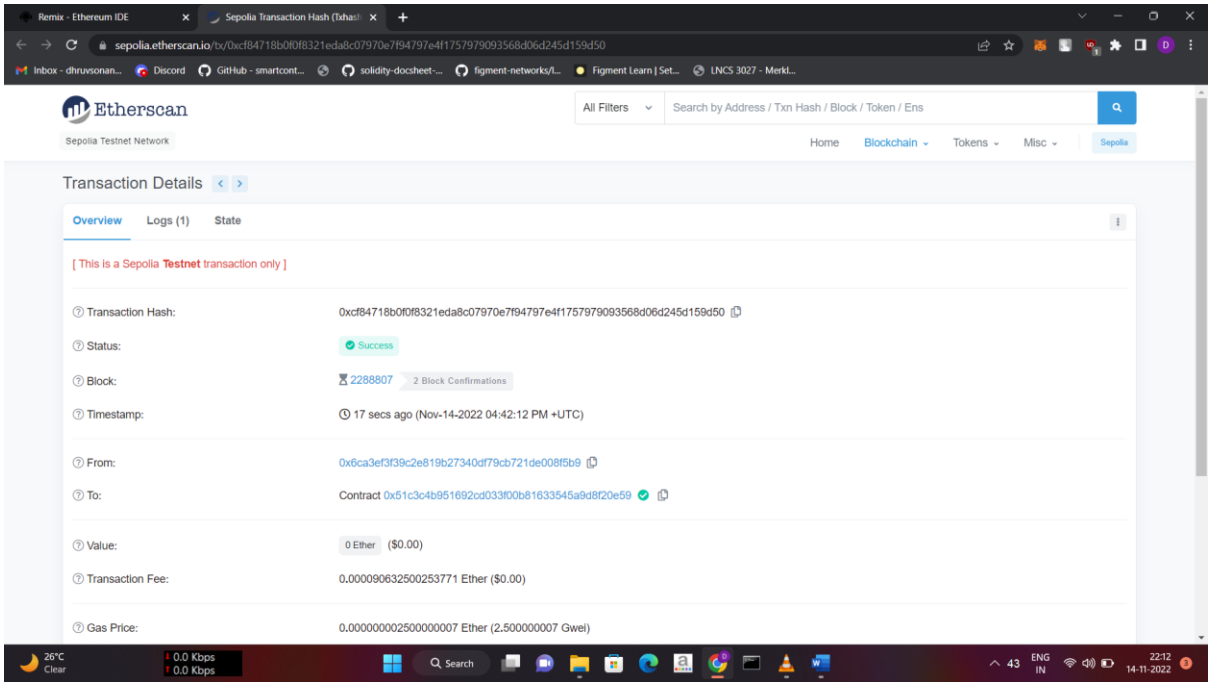
event Transfer(address indexed from, address indexed to, uint tokens);
listen on all transactions
Search with transaction hash or address
transact to IntelliContract.burnTokens pending ...
MetaMask Notification
Edit
Sepolia test network
Account 1
0x51c...0E59
New address detected! Click here to add to your address book.
https://remix.ethereum.org
0x51c...0E59 : CONTRACT INTERACTION
DETAILS
DATA
HEX
EDIT
Estimated gas fee
Site suggested
Max fee:
Total
0.00009063
0.00009063 SepoliaETH
26°C
Clear
14.1 Kbps
30.8 Kbps
Search
ENG
IN
22:11
14-11-2022


Remix - Ethereum IDE
Sepolia Transaction Hash (Txhash)
sepolia.etherscan.io/tx/0xcf84718b0f0f8321eda8c07970e7f94797e4f1757979093568d06d245d159d50
Etherscan
Sepolia Testnet Network
All Filters
Search by Address / Txn Hash / Block / Token / Ens
Home
Blockchain
Tokens
Misc
Sepolia
Transaction Details
Overview
[This is a Sepolia Testnet transaction only]
Transaction Hash:
0xcf84718b0f0f8321eda8c07970e7f94797e4f1757979093568d06d245d159d50
Status:
Pending
This txn hash was found in our secondary node and should be picked up by our indexer in a short while.
Block:
(Pending)
Timestamp:
(Pending)
From:
0x6ca3ef3f39c2e819b27340df79cb721de008f5b9
To:
0x51c3c4b951692cd033f00b81633545a9d8f20e59
Value:
0 Ether ($0.00)
Transaction Fee:
(Pending)
Gas Price:
0.000000002500000014 Ether (2.500000014 Gwei)
Google Chrome
Confirmed transaction
Transaction 5 confirmed! View on Etherscan
26°C
Clear
0.5 Kbps
2.8 Kbps
Search
ENG
IN
22:12
14-11-2022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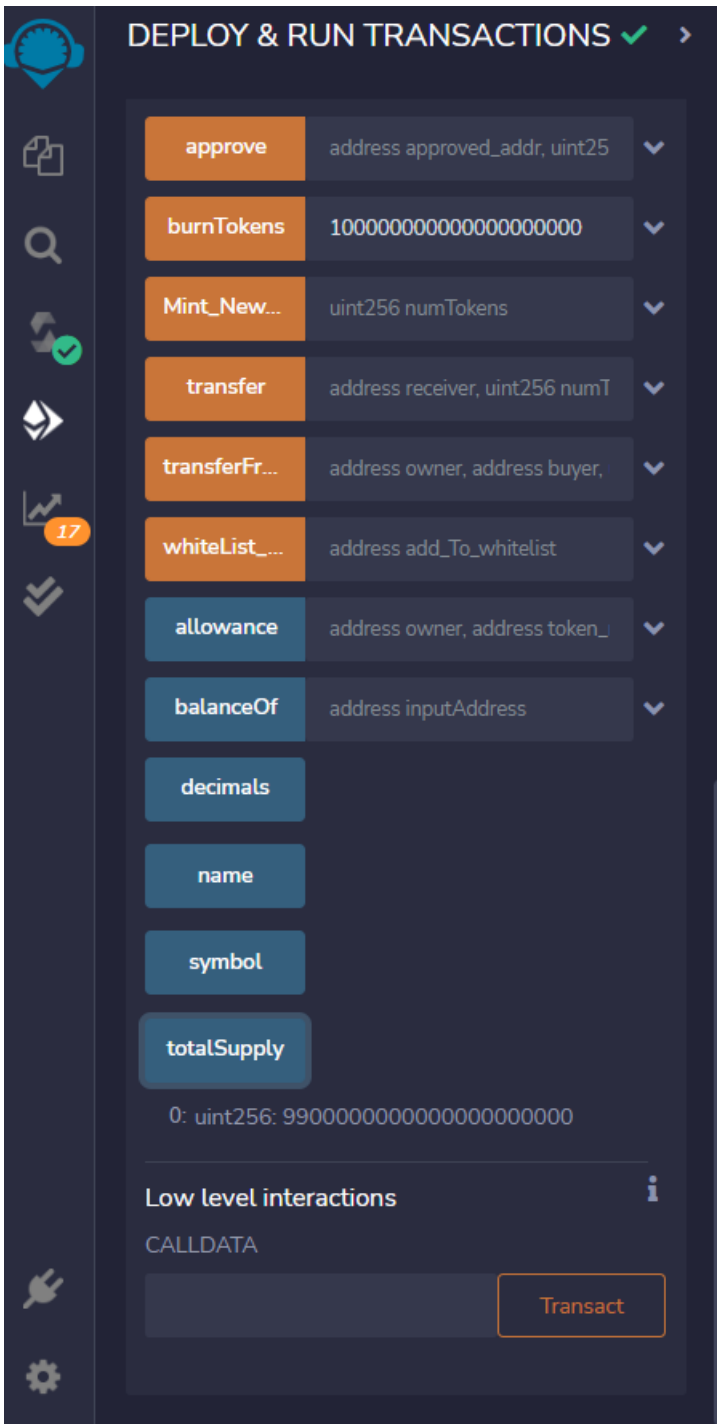
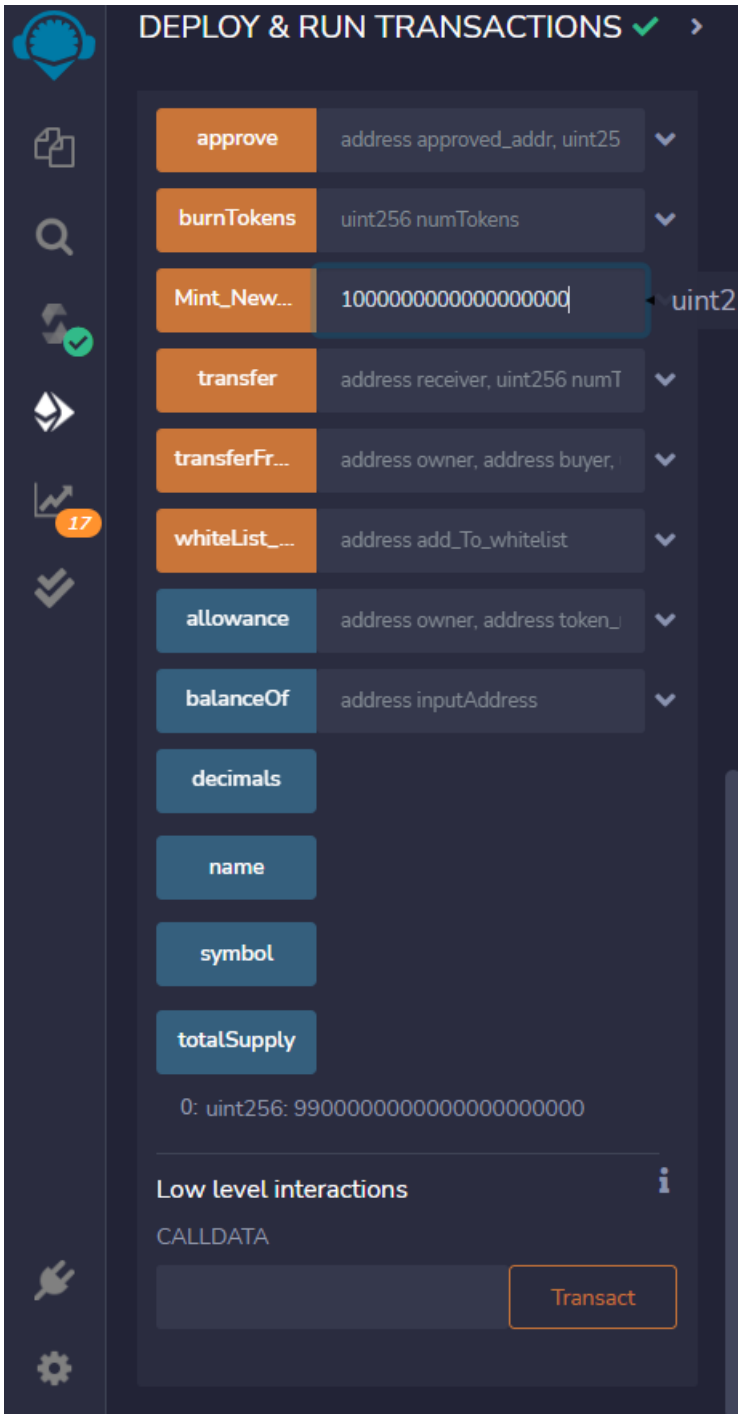
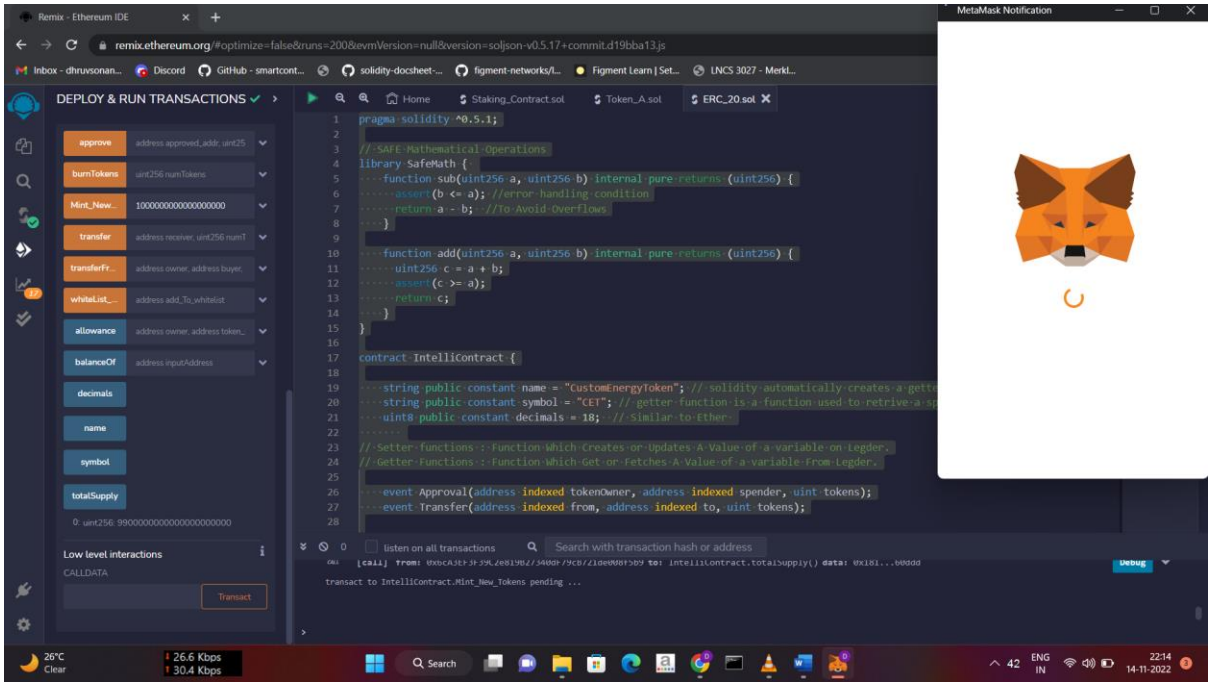
Transaction Details
Overview
Logs (1)
State
[This is a Sepolia Testnet transaction only]
Transaction Hash:
0xcf84718b0f0f8321eda8c07970e7f94797e4f1757979093568d06d245d159d50
Status:
Success
Block:
2288807
2 Block Confirmations
Timestamp:
17 secs ago (Nov-14-2022 04:42:12 PM +UTC)
From:
0x6ca3ef3f39c2e819b27340df79cb721de008f5b9
To:
Contract 0x51c3c4b951692cd033f00b81633545a9d8f20e59
Value:
0 Ether
($0.00)
Transaction Fee:
0.000090632500253771 Ether ($0.00)
Gas Price:
0.000000002500000007 Ether (2.500000007 Gwei)
26°C
Clear
0.0 Kbps
0.0 Kbps
Search
ENG
IN
22:12
14-11-2022

Token_Supply after burning:



Minting new custom tokens:

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26°C
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ENG
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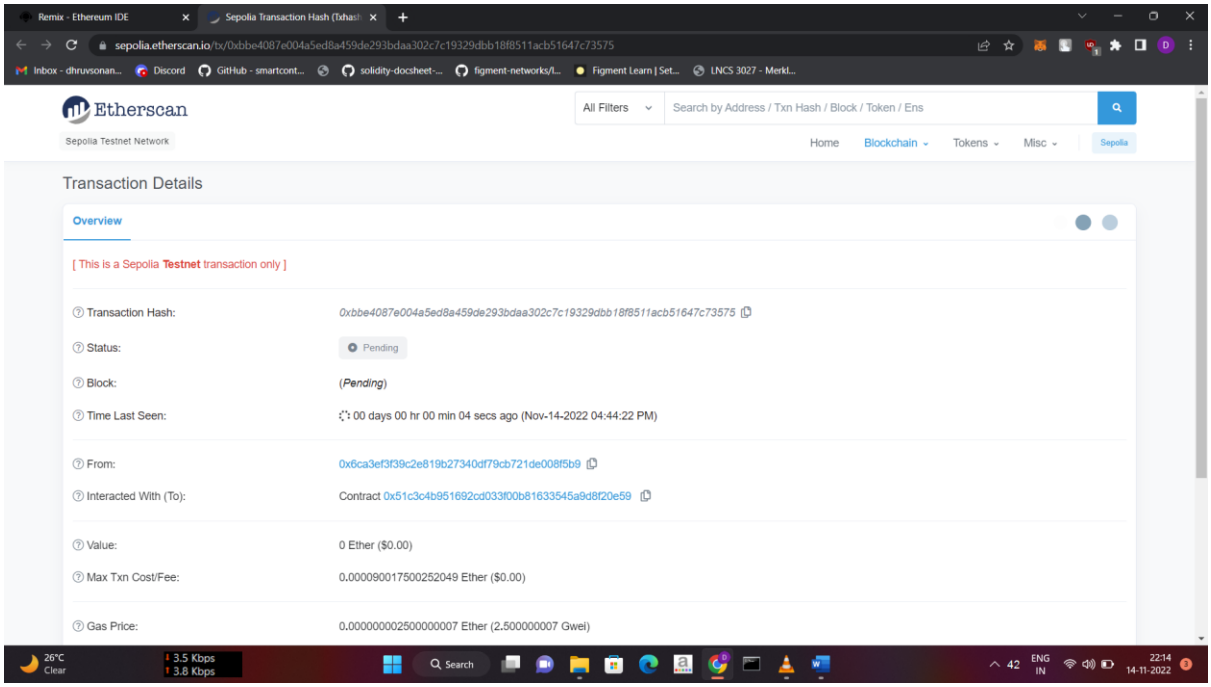
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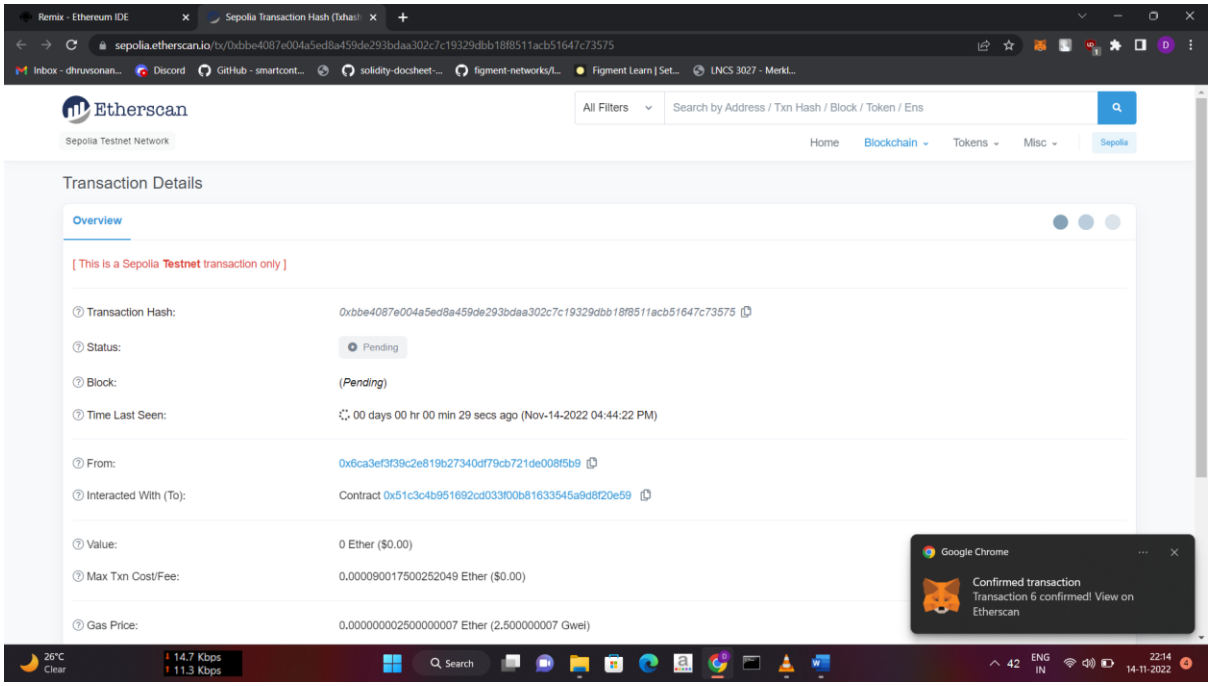
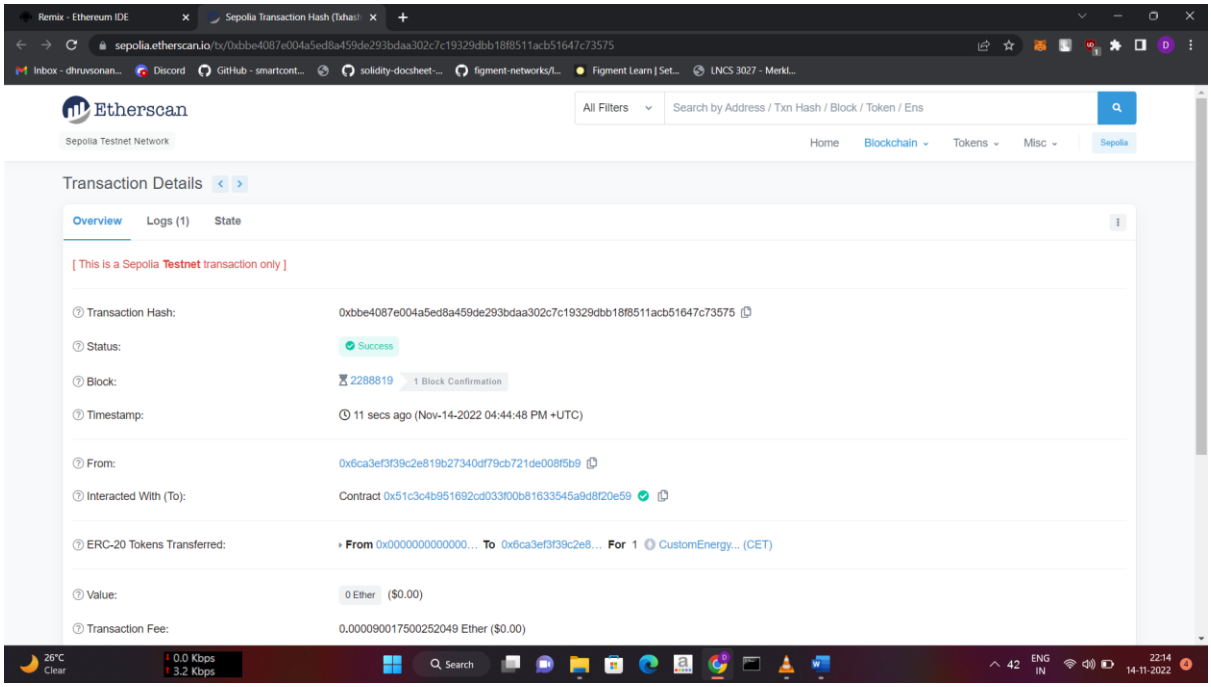
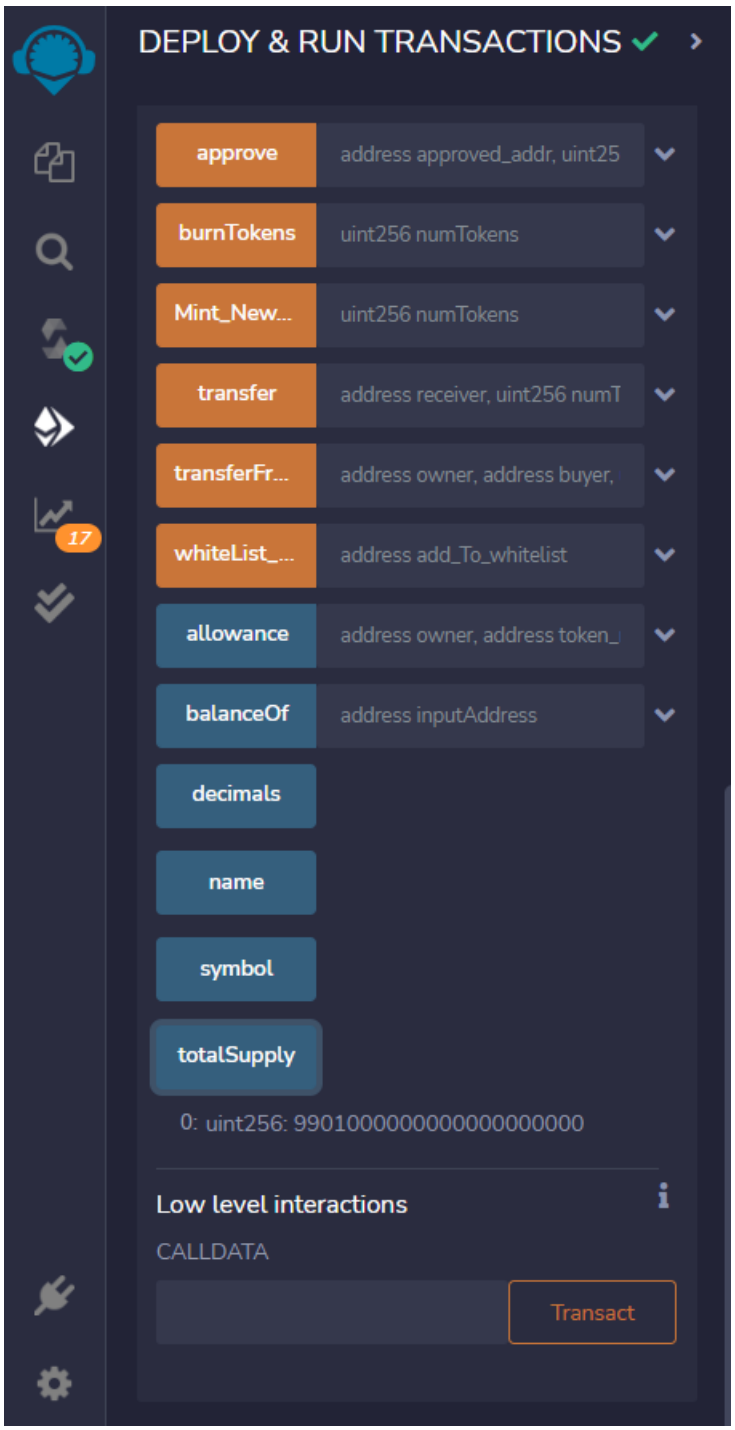
sepolia.etherscan.io/tx/0xbbe4087e004a5ed8a459de293bdaa302c7c19329dbb18f8511acb51647c73575
Etherscan
Sepolia Testnet Network
All Filters
Search by Address / Txn Hash / Block / Token / Ens
Home
Blockchain
Tokens
Misc
Sepolia
Transaction Details
Overview
[This is a Sepolia Testnet transaction only]
Transaction Hash:
0xbbe4087e004a5ed8a459de293bdaa302c7c19329dbb18f8511acb51647c73575
Status:
Pending
Block:
(Pending)
Time Last Seen:
00 days 00 hr 00 min 04 secs ago (Nov-14-2022 04:44:22 PM)
From:
0x6ca3ef3f39c2e819b27340df79cb721de008f5b9
Interacted With (To):
Contract 0x51c3c4b951692cd033f00b81633545a9d8f20e59
Value:
0 Ether ($0.00)
Max Txn Cost/Fee:
0.000090017500252049 Ether ($0.00)
Gas Price:
0.000000002500000007 Ether (2.500000007 Gwei)
26°C
Clear
3.5 Kbps
3.8 Kbps
Search
ENG
IN
22:14
14-11-2022

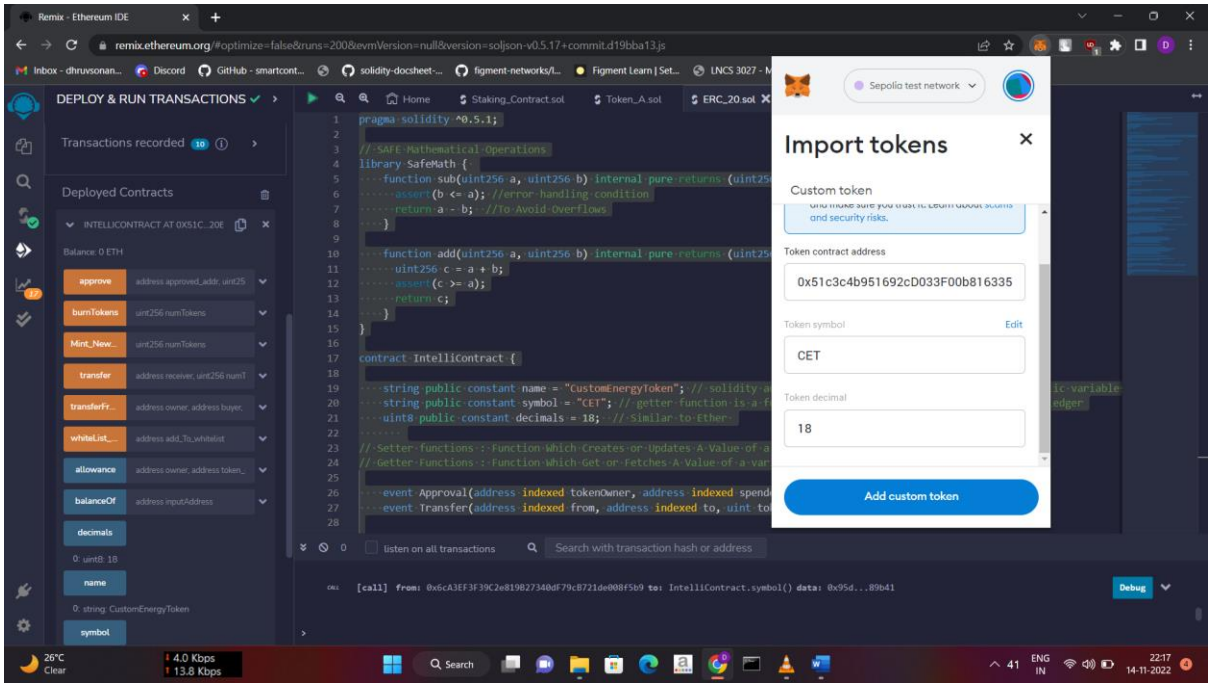

Remix - Ethereum IDE
Sepolia Transaction Hash (Txhash
sepolia.etherscan.io/tx/0xbbe4087e004a5ed8a459de293bdaa302c7c19329dbb18f8511acb51647c73575
Etherscan
Sepolia Testnet Network
All Filters
Search by Address / Txn Hash / Block / Token / Ens
Home
Blockchain
Tokens
Misc
Sepolia
Transaction Details
Overview
[This is a Sepolia Testnet transaction only]
Transaction Hash:
0xbbe4087e004a5ed8a459de293bdaa302c7c19329dbb18f8511acb51647c73575
Status:
Pending
Block:
(Pending)
Time Last Seen:
00 days 00 hr 00 min 29 secs ago (Nov-14-2022 04:44:22 PM)
From:
0x6ca3ef3f39c2e819b27340df79cb721de008f5b9
Interacted With (To):
Contract 0x51c3c4b951692cd033f00b81633545a9d8f20e59
Value:
0 Ether ($0.00)
Max Txn Cost/Fee:
0.000090017500252049 Ether ($0.00)
Gas Price:
0.000000002500000007 Ether (2.500000007 Gwei)
Google Chrome
Confirmed transaction
Transaction 6 confirmed! View on Etherscan
26°C
Clear
14.7 Kbps
11.3 Kbps
Search
ENG
IN
22:14
14-11-2022

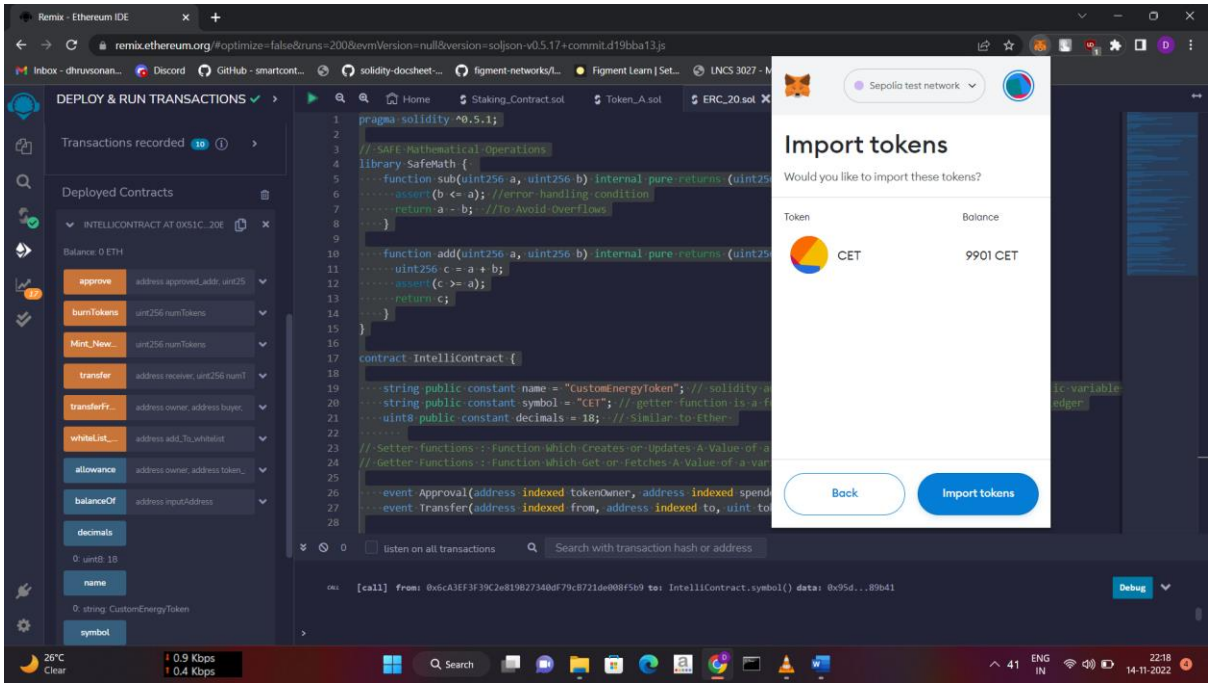

Remix - Ethereum IDE
Sepolia Transaction Hash (Txhash
sepolia.etherscan.io/tx/0xbbe4087e004a5ed8a459de293bdaa302c7c19329dbb18f8511acb51647c73575
Etherscan
Sepolia Testnet Network
All Filters
Search by Address / Txn Hash / Block / Token / Ens
Home
Blockchain
Tokens
Misc
Sepolia
Transaction Details
Overview
Logs (1)
State
[This is a Sepolia Testnet transaction only]
Transaction Hash:
0xbbe4087e004a5ed8a459de293bdaa302c7c19329dbb18f8511acb51647c73575
Status:
Success
Block:
2288819
1 Block Confirmation
Timestamp:
11 secs ago (Nov-14-2022 04:44:48 PM +UTC)
From:
0x6ca3ef3f39c2e819b27340df79cb721de008f5b9
Interacted With (To):
Contract 0x51c3c4b951692cd033f00b81633545a9d8f20e59
ERC-20 Tokens Transferred:
From 0x0000000000000... To 0x6ca3ef3f39c2e8... For 1 CustomEnergy... (CET)
Value:
0 Ether ($0.00)
Transaction Fee:
0.000090017500252049 Ether ($0.00)
26°C
Clear
0.0 Kbps
3.2 Kbps
Search
ENG
IN
22:14
14-11-2022

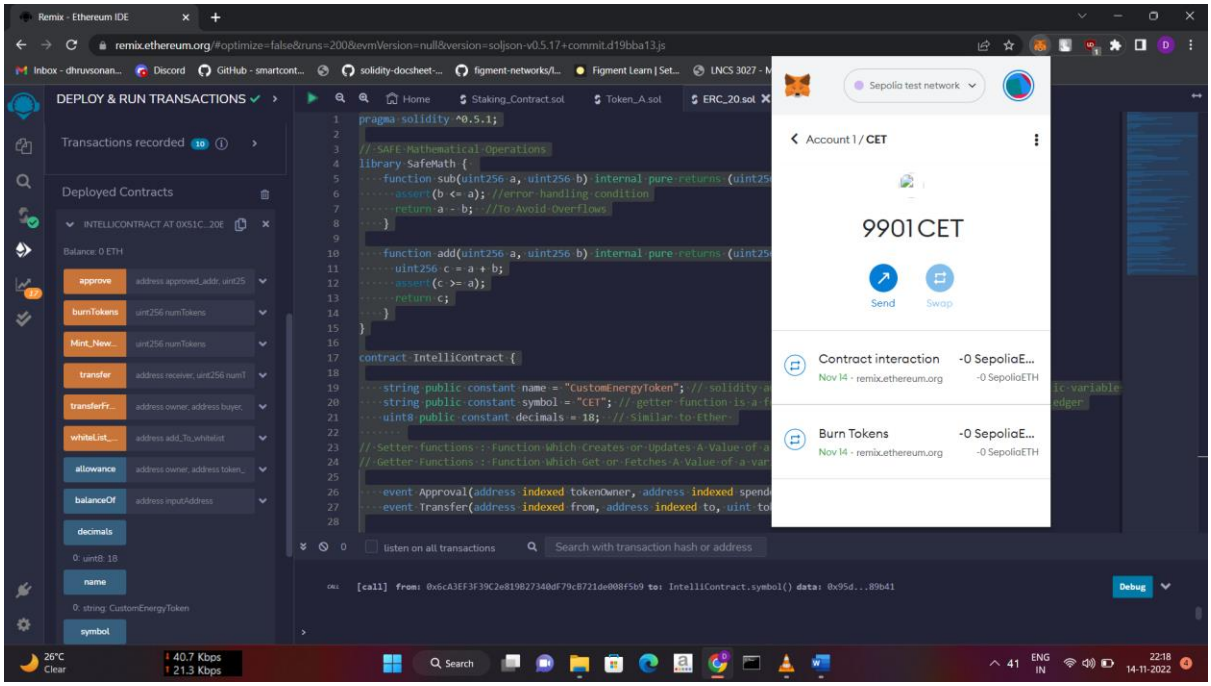
After minting new custom tokens, total supply:



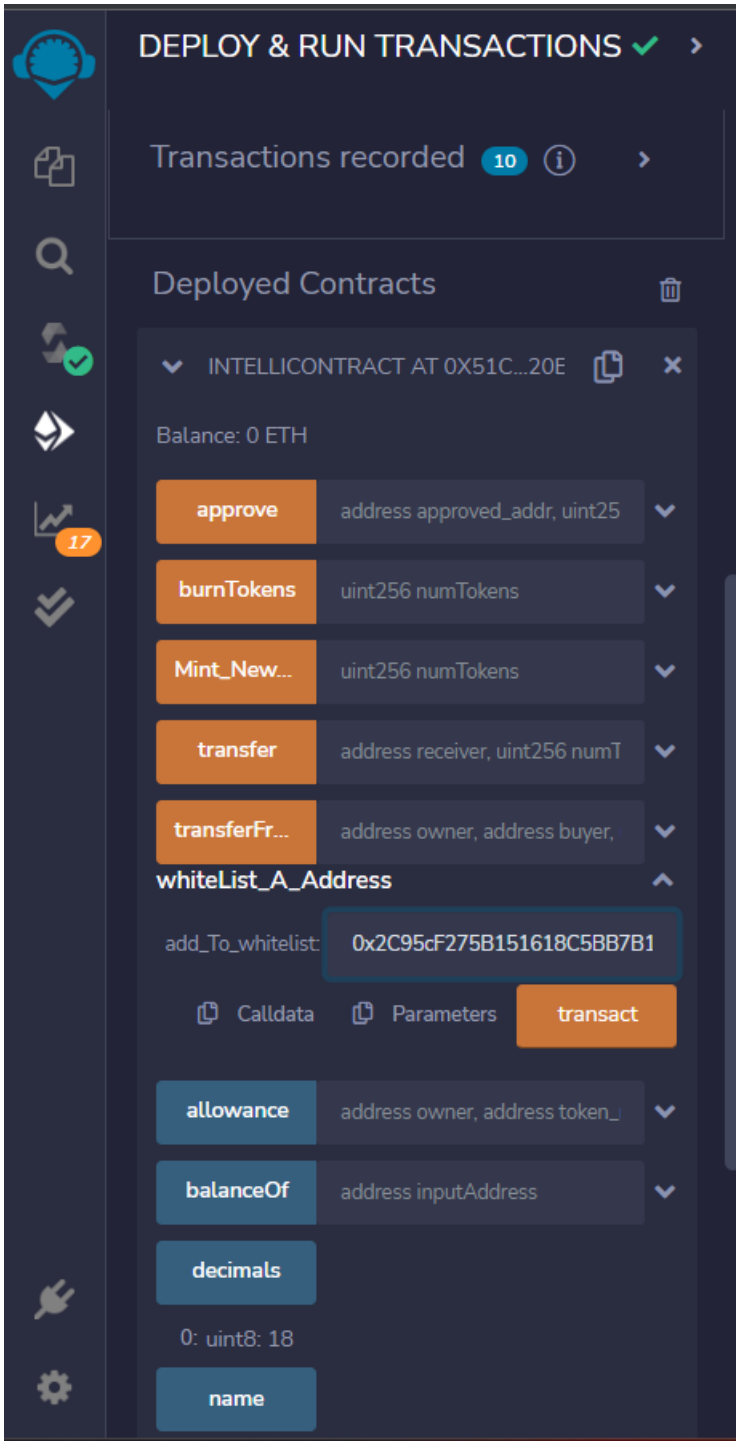
Importing Tokens into metamask wallet:

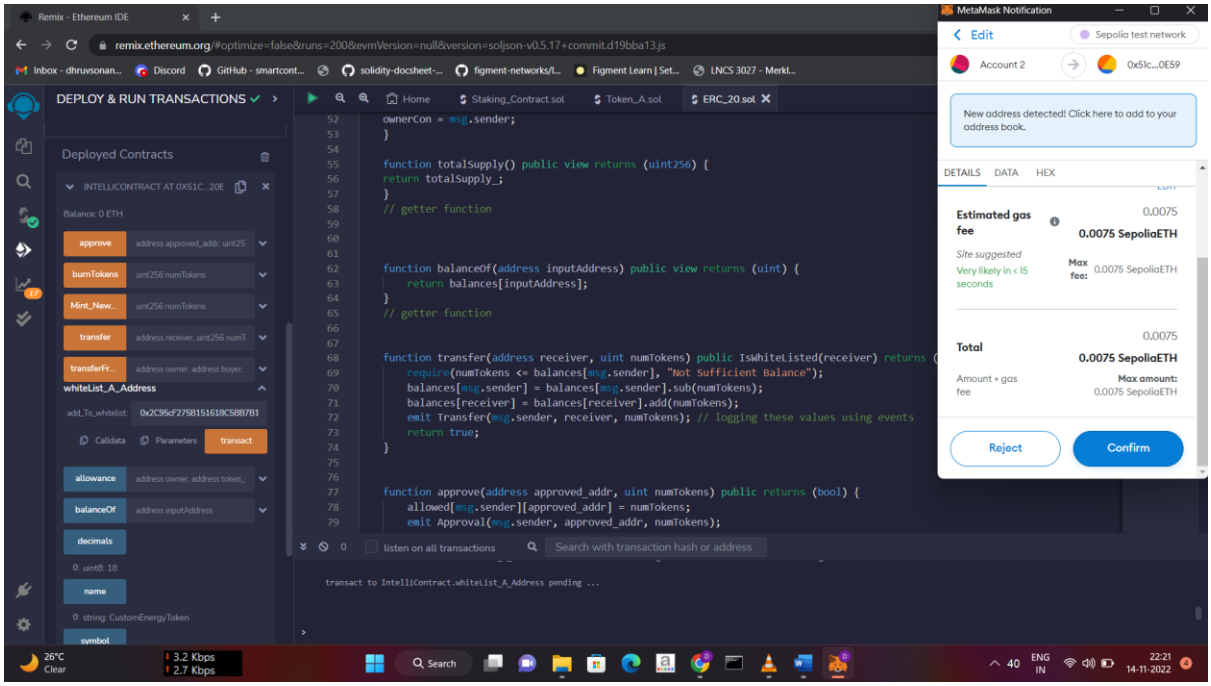


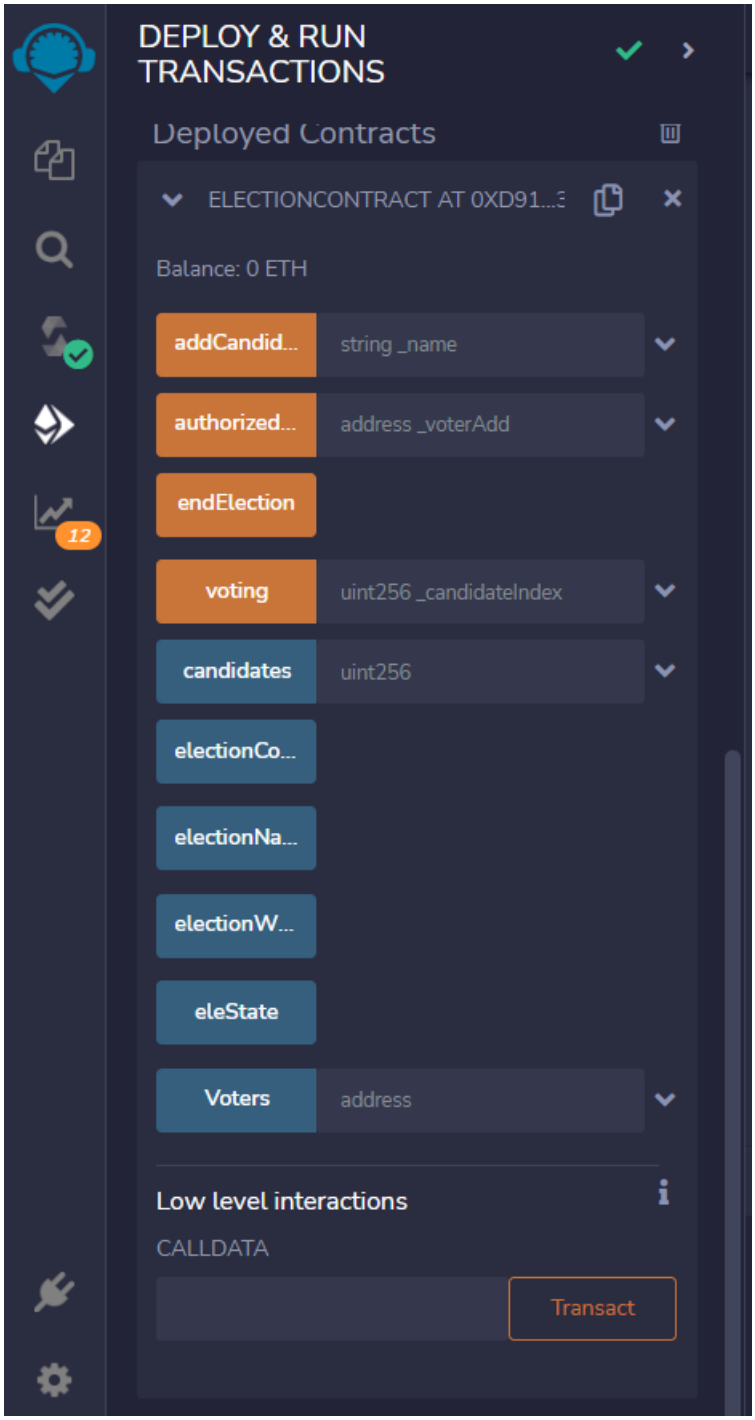


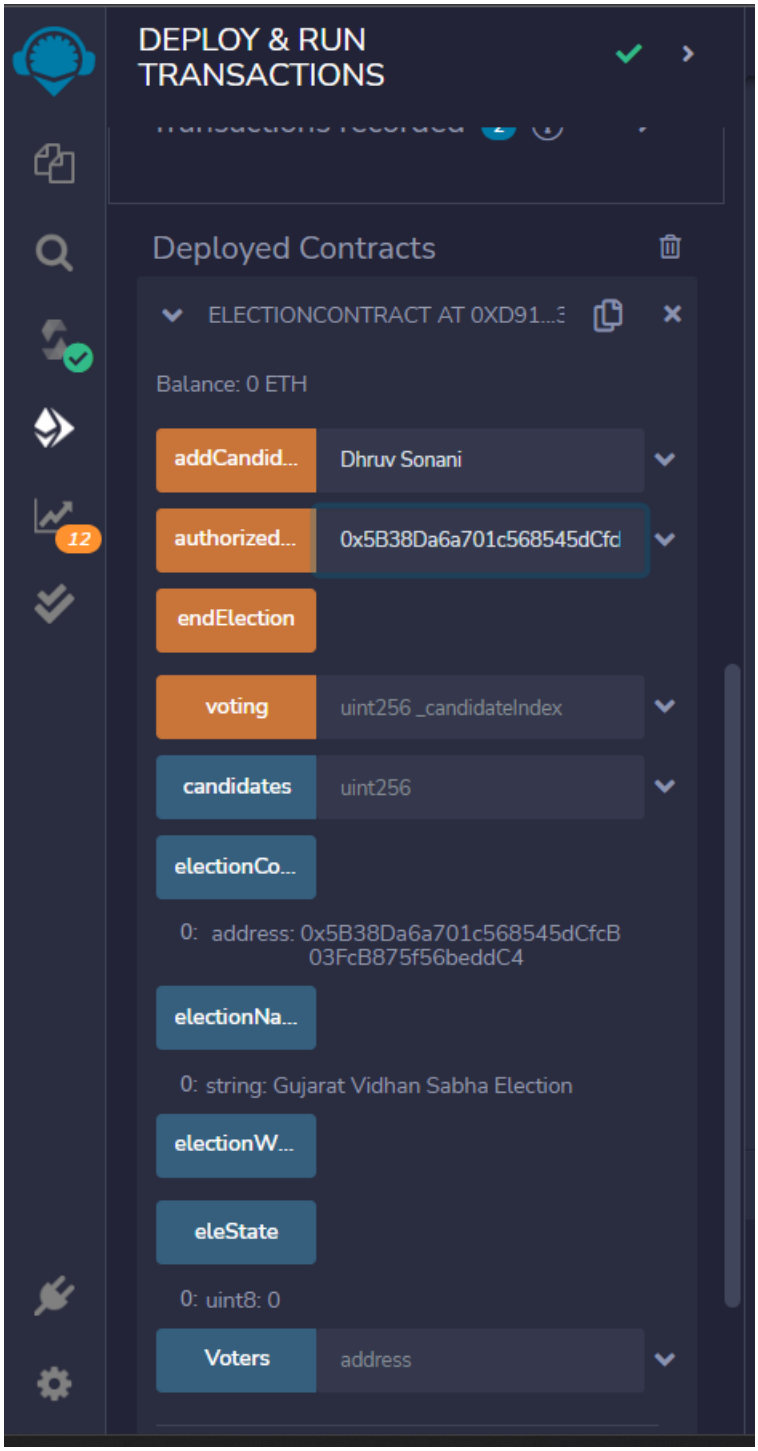

Remix - Ethereum IDE
remix.ethereum.org/#optimize=false&runs=200&evmVersion=null&version=soljson-v0.5.17+commit.d19bba13.js
DEPLOY & RUN TRANSACTIONS
Transactions recorded 10
Deployed Contracts
INTELLICONTRACT AT 0X51C...20E
Balance: 0 ETH
approve
burnTokens
Mint_New...
transfer
transferFr...
whiteList_...
allowance
balanceOf
decimals
0: uint8: 18
name
0: string: CustomEnergyToken
symbol
Home
Staking_Contract.sol
Token_A.sol
ERC_20.sol
pragma solidity ^0.5.1;
//SAFE Mathematical Operations
library SafeMath {
function sub(uint256 a, uint256 b) internal pure returns (uint25
assert(b <= a); //error handling condition
return a - b; //To Avoid Overflows
}
function add(uint256 a, uint256 b) internal pure returns (uint25
uint256 c = a + b;
assert(c >= a);
return c;
}
}
contract IntelliContract {
string public constant name = "CustomEnergyToken"; // solidity
string public constant symbol = "CET"; // getter function is a f
uint8 public constant decimals = 18; //Similar to Ether
//Setter functions ::Function which Creates or Updates A Value of a
//Getter Functions ::Function which Get or Fetches A Value of a var
event Approval(address indexed tokenOwner, address indexed spend
event Transfer(address indexed from, address indexed to, uint to
listen on all transactions
Search with transaction hash or address
[call] from: 0x6cA3EF3F39C2e819B27340dF79cB721de008f5b9 to: IntelliContract.symbol() data: 0x95d...89b41
Debug
Sepolia test network
Account 1 / CET
9901 CET
Send
Swap
Contract interaction
Nov 14 · remix.ethereum.org
-0 SepoliaE...
-0 SepoliaETH
Burn Tokens
Nov 14 · remix.ethereum.org
-0 SepoliaE...
-0 SepoliaETH
26°C
Clear
40.7 Kbps
21.3 Kbps
Search
ENG
IN
22:18
14-11-2022

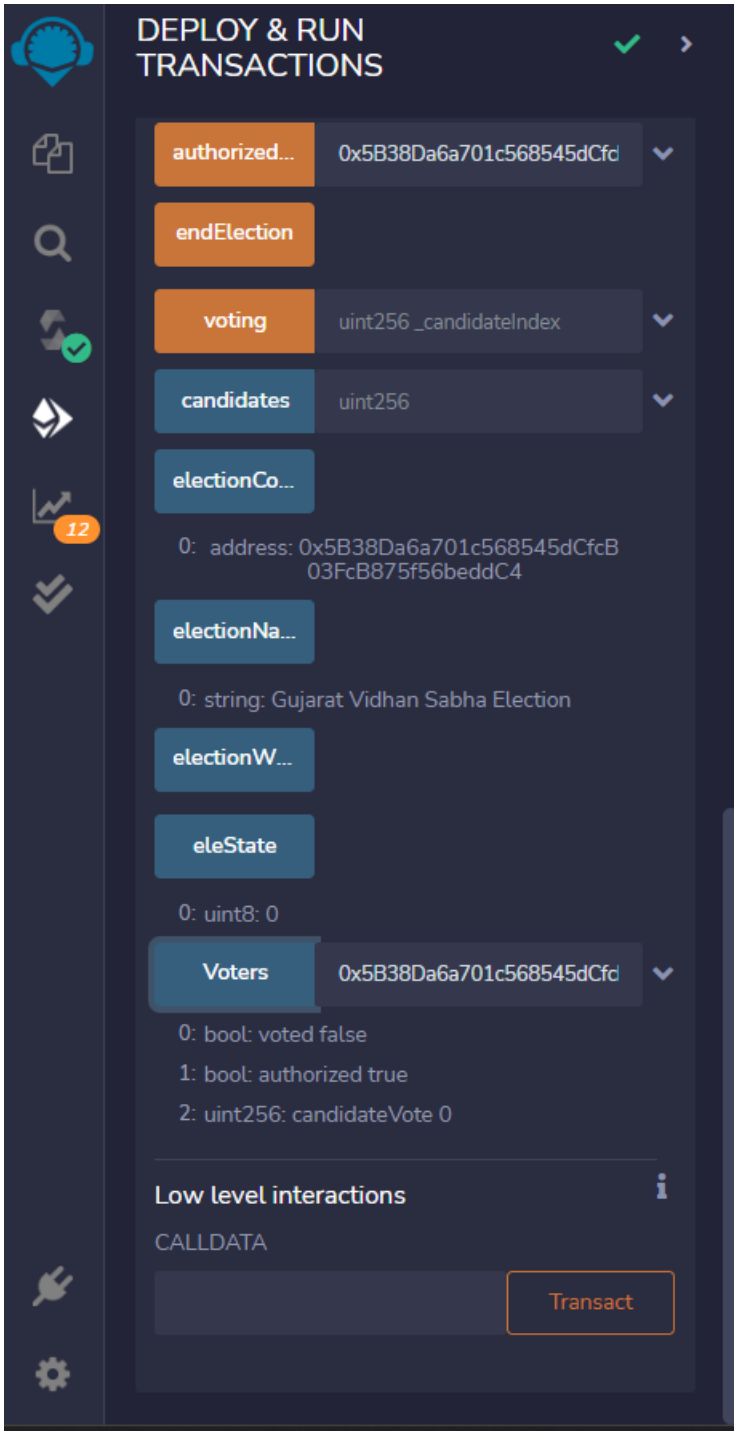
Whitelist a address(here we are whitelisting our account 2 of metamask):

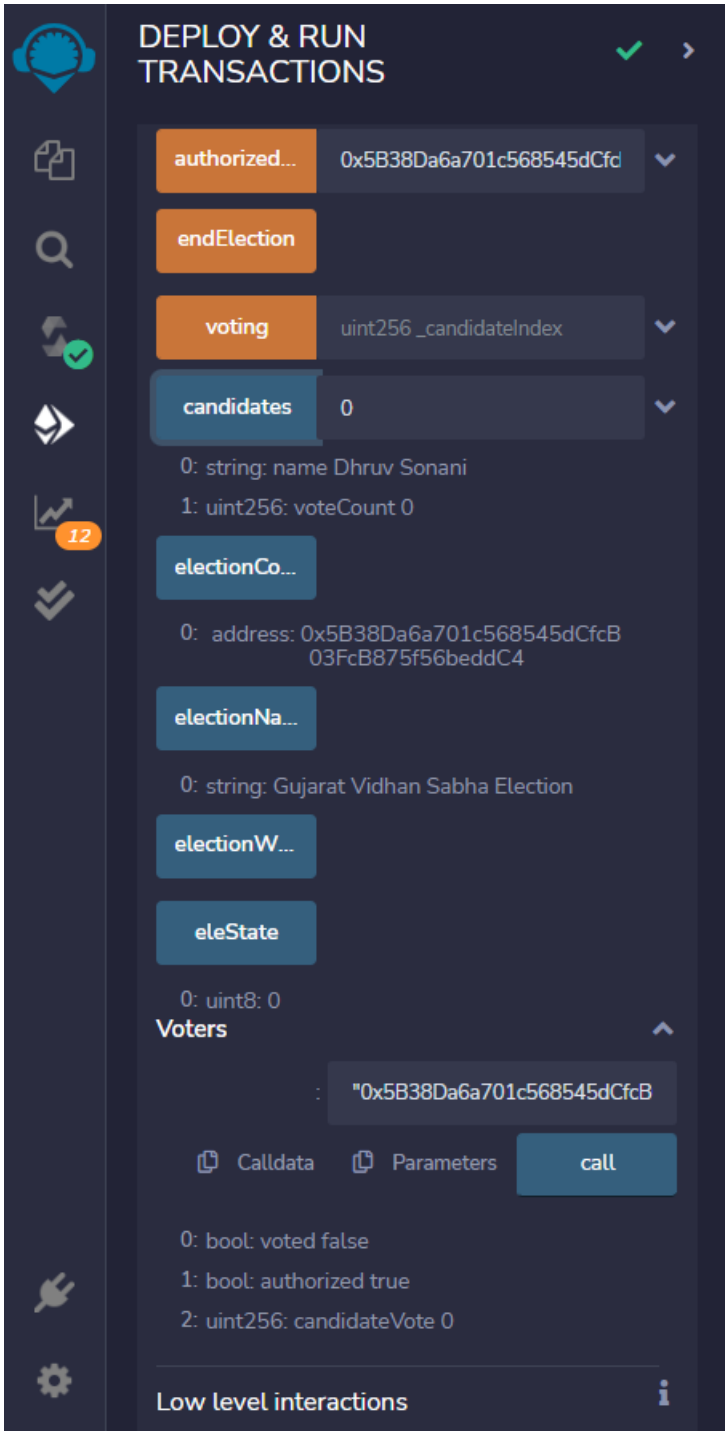


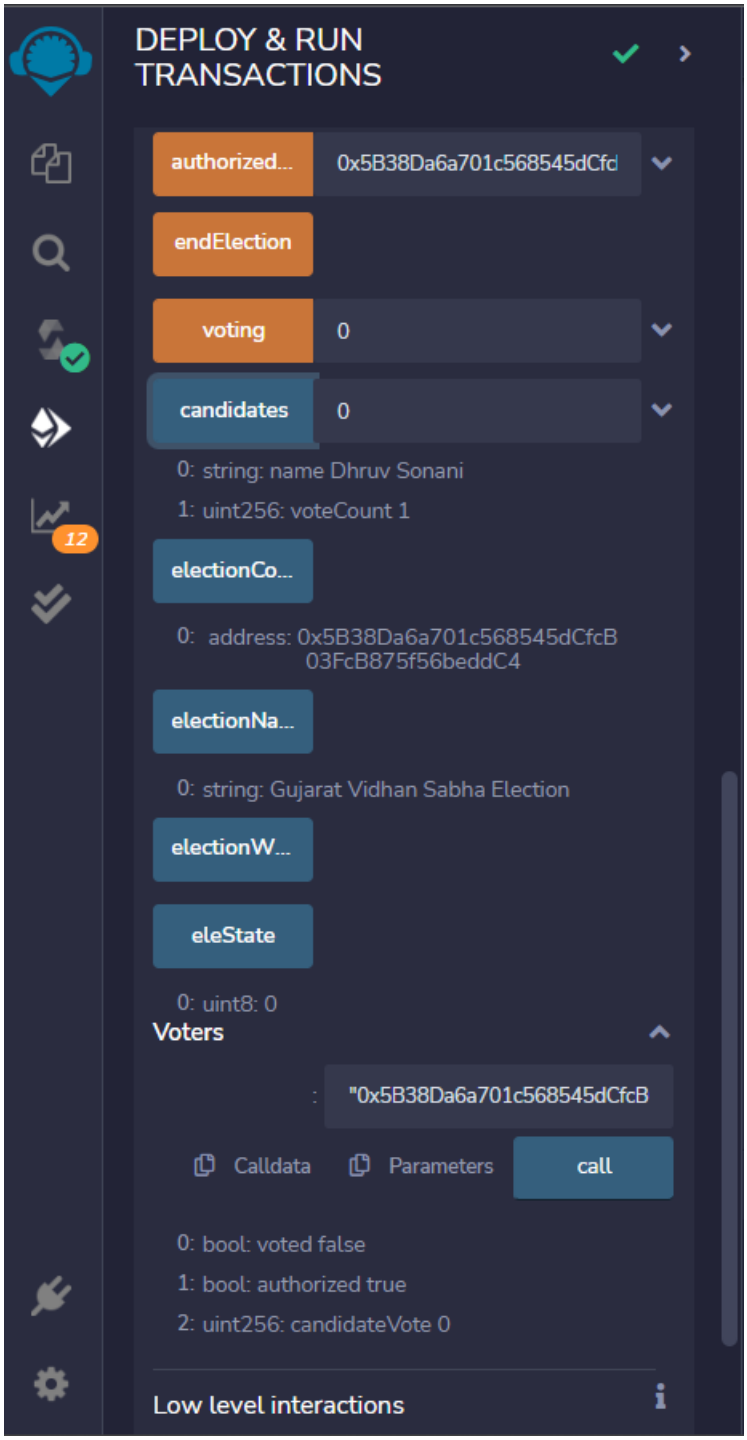

Remix - Ethereum IDE
remix.ethereum.org/#optimize=false&runs=200&evmVersion=null&version=soljson-v0.5.17+commit.d19bba13.js
DEPLOY & RUN TRANSACTIONS
Deployed Contracts
Home
Staking_Contract.sol
Token_A.sol
ERC_20.sol
ownerCon = msg.sender;
}
function totalSupply() public view returns (uint256) {
return totalSupply_;
}
// getter function
function balanceOf(address inputAddress) public view returns (uint) {
return balances[inputAddress];
}
// getter function
function transfer(address receiver, uint numTokens) public IsWhiteListed(receiver) returns (
require(numTokens <= balances[msg.sender], "Not Sufficient Balance");
balances[msg.sender] = balances[msg.sender].sub(numTokens);
balances[receiver] = balances[receiver].add(numTokens);
emit Transfer(msg.sender, receiver, numTokens); // logging these values using events
return true;
}
function approve(address approved_addr, uint numTokens) public returns (bool) {
allowed[msg.sender][approved_addr] = numTokens;
emit Approval(msg.sender, approved_addr, numTokens);
approve
burnTokens
Mint_New...
transfer
transferFr...
whiteList_A_Address
add_To_whitelist
0x2C95cF275B151618C58B7B1
Calldata
Parameters
transact
allowance
balanceOf
decimals
name
symbol
listen on all transactions
Search with transaction hash or address
transact to IntelliContract.whiteList_A_Address pending ...
MetaMask Notification
Edit
Sepolia test network
Account 2
0x51c...0E59
New address detected! Click here to add to your address book.
DETAILS
DATA
HEX
Estimated gas fee
0.0075
0.0075 SepoliaETH
Site suggested
Very likely in < 15 seconds
Max fee:
0.0075 SepoliaETH
Total
0.0075
0.0075 SepoliaETH
Amount + gas fee
Max amount:
0.0075 SepoliaETH
Reject
Confirm
26°C
Clear
3.2 Kbps
2.7 Kbps
Search
ENG
IN
22:21
14-11-2022

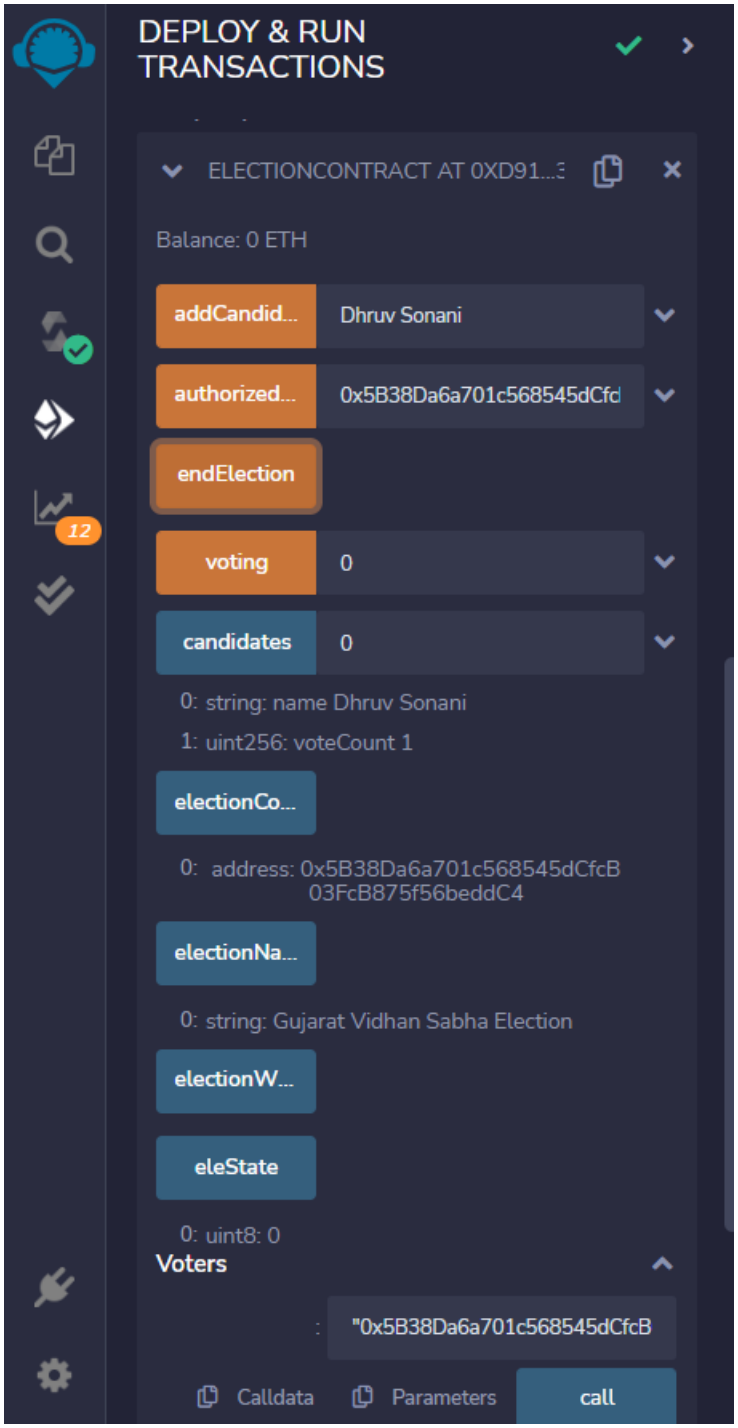

DEPLOY & RUN TRANSACTIONS
Deployed Contracts
ELECTIONCONTRACT AT 0XD91...3
Balance: 0 ETH
addCandid...
string _name
authorized...
address _voterAdd
endElection
voting
uint256 _candidateIndex
candidates
uint256
electionCo...
electionNa...
electionW...
eleState
Voters
address
Low level interactions
CALLDATA
Transact
12

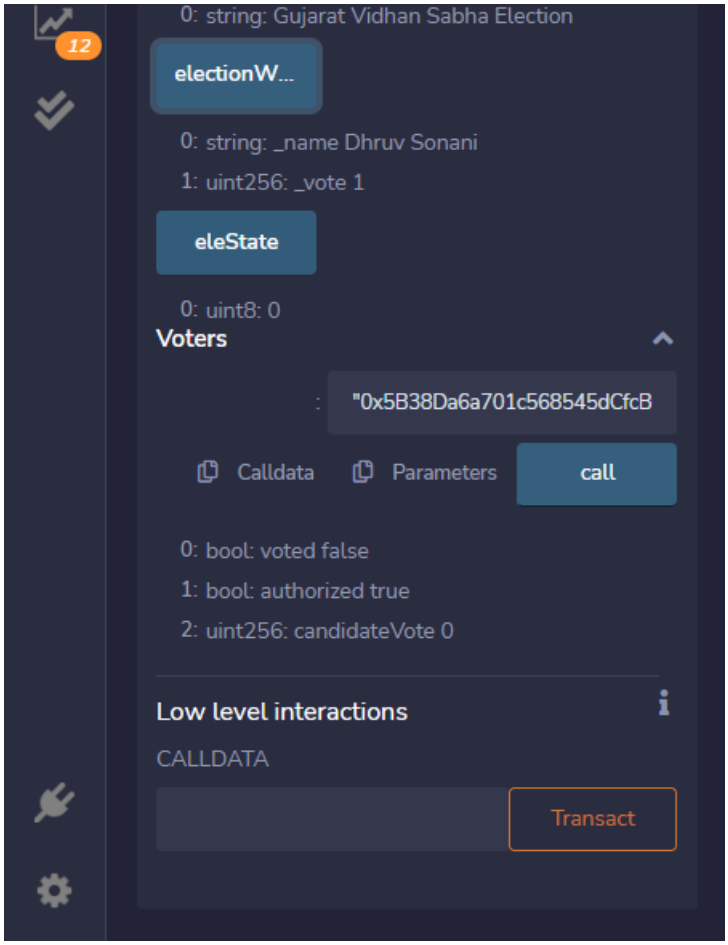

DEPLOY & RUN
TRANSACTIONS
Deployed Contracts
ELECTIONCONTRACT AT 0XD91...3
Balance: 0 ETH
addCandid...
Dhruv Sonani
authorized...
0x5B38Da6a701c568545dCfd
endElection
voting
uint256 _candidateIndex
candidates
uint256
electionCo...
0: address: 0x5B38Da6a701c568545dCfcB
03FcB875f56beddC4
electionNa...
0: string: Gujarat Vidhan Sabha Election
electionW...
eleState
0: uint8: 0
Voters
address
12


DEPLOY & RUN TRANSACTIONS
authorized...
0x5B38Da6a701c568545dCfd
endElection
voting
uint256 _candidateIndex
candidates
uint256
electionCo...
0: address: 0x5B38Da6a701c568545dCfcB 03FcB875f56beddC4
electionNa...
0: string: Gujarat Vidhan Sabha Election
electionW...
eleState
0: uint8: 0
Voters
0x5B38Da6a701c568545dCfd
0: bool: voted false
1: bool: authorized true
2: uint256: candidateVote 0
Low level interactions
CALLDATA
Transact
12


DEPLOY & RUN TRANSACTIONS
authorized...
0x5B38Da6a701c568545dCfd
endElection
voting
uint256 _candidateIndex
candidates
0
0: string: name Dhruv Sonani
1: uint256: voteCount 0
electionCo...
0: address: 0x5B38Da6a701c568545dCfcB 03FcB875f56beddC4
electionNa...
0: string: Gujarat Vidhan Sabha Election
electionW...
eleState
0: uint8: 0
Voters
"0x5B38Da6a701c568545dCfcB
Calldata
Parameters
call
0: bool: voted false
1: bool: authorized true
2: uint256: candidateVote 0
Low level interactions


DEPLOY & RUN TRANSACTIONS
authorized...
0x5B38Da6a701c568545dCfd
endElection
voting
0
candidates
0
0: string: name Dhruv Sonani
1: uint256: voteCount 1
electionCo...
0: address: 0x5B38Da6a701c568545dCfcB 03FcB875f56beddC4
electionNa...
0: string: Gujarat Vidhan Sabha Election
electionW...
eleState
0: uint8: 0
Voters
"0x5B38Da6a701c568545dCfcB
Calldata
Parameters
call
0: bool: voted false
1: bool: authorized true
2: uint256: candidateVote 0
Low level interactions


DEPLOY & RUN TRANSACTIONS
ELECTIONCONTRACT AT 0XD91...3
Balance: 0 ETH
addCandid...
Dhruv Sonani
authorized...
0x5B38Da6a701c568545dCfd
endElection
voting
0
candidates
0
0: string: name Dhruv Sonani
1: uint256: voteCount 1
electionCo...
0: address: 0x5B38Da6a701c568545dCfcB 03FcB875f56beddC4
electionNa...
0: string: Gujarat Vidhan Sabha Election
electionW...
eleState
0: uint8: 0
Voters
"0x5B38Da6a701c568545dCfcB
Calldata
Parameters
call


0: string: Gujarat Vidhan Sabha Election
electionW...
0: string: _name Dhruv Sonani
1: uint256: _vote 1
eleState
0: uint8: 0
Voters
"0x5B38Da6a701c568545dCfcB
Calldata
Parameters
call
0: bool: voted false
1: bool: authorized true
2: uint256: candidateVote 0
Low level interactions
CALLDATA
Transact