INTERACTION WITH FRONTEND

Interact With The Frontend For All Functionalities

Team Id	NM2023TMID04410
Project Name	Drug Traceability

Interacting with the frontend in a smart contracts drug traceability system:

In a smart contract-based drug traceability system on the blockchain, interacting with the frontend involves a different set of functionalities and user actions compared to traditional systems. Here's how users interact with the frontend in such a system:

1.User Authentication:

- Users log in to the frontend using their credentials, which may be linked to their blockchain wallet addresses.
- Blockchain wallets and private keys are used for authentication.

2.Data Entry:

- Users can initiate the creation of new drug traceability records on the blockchain.
- They input data about drug products, such as serial numbers, batch information, and product details.

3.Data Retrieval and Verification:

- Users query the blockchain to retrieve information about drug products.
- They can verify the authenticity of products by checking the blockchain records.

4.Smart Contract Interactions:

- Users may interact directly with smart contracts through the frontend.
- This includes initiating actions like product transfers, ownership changes, or batch updates.

5.Alerts and Notification:

- The frontend can display alerts and notifications based on predefined smart contract conditions.
- Users receive alerts when specific events occur on the blockchain.

6.Inventory Management:

- Users can manage their inventory of drug products on the blockchain.
- They can add new products, update quantities, and track product movements.

7.Blockchain Explorer:

- The frontend may provide access to a blockchain explorer, allowing users to explore the blockchain's entire transaction history and traceability records.

8.Reporting and Analytics:

- Users can generate reports and analytics based on data recorded in smart contracts.
- They can visualize data on the frontend through charts and graphs.

9.User Training and Support:

- Training materials and documentation are available to guide users on how to interact with smart contracts on the blockchain.
- Support channels are accessible for assistance.

10.Security Measures:

- Users must manage their blockchain wallet security and private keys, which is critical for accessing and interacting with smart contracts.
- Encryption and secure key management are emphasized.

11.Mobile Optimization:

- The frontend may be optimized for mobile access, allowing users to perform blockchain interactions from their mobile devices.

12.User Acceptance Testing (UAT):

- Users participate in UAT to test the frontend's functionality and provide feedback.
- Testing includes smart contract interactions and blockchain-related actions.

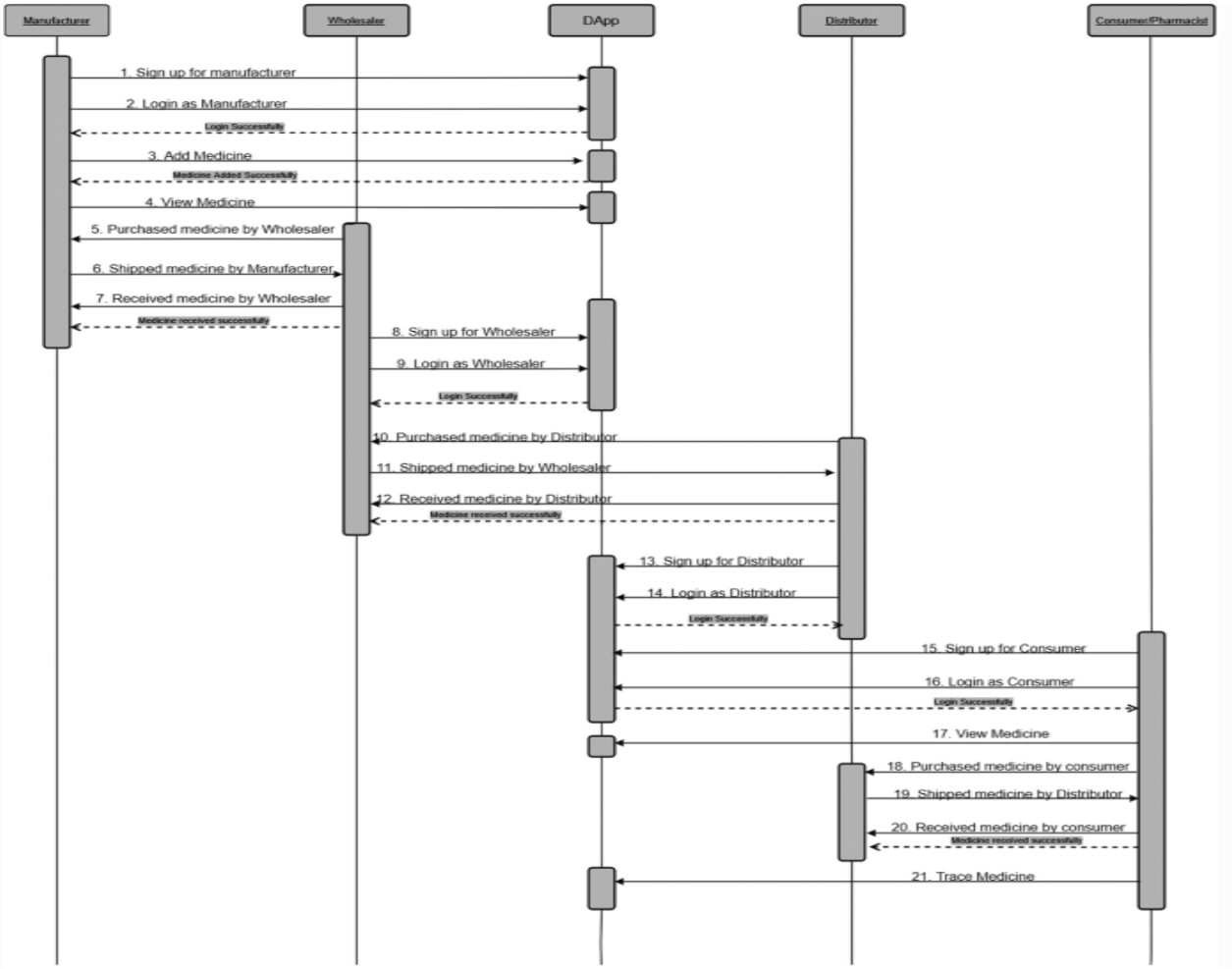
13.Deployment and Maintenance:

- After UAT, the frontend is deployed to production, ensuring that users can perform secure interactions with the blockchain.
- Ongoing maintenance and updates are essential for the blockchain system's integrity.

Implementation:

- The Ethereum blockchain platform is being used to develop the proposed solution. Ethereum is a permissionless public blockchain, which means that anyone can access it.

- The truffle framework is used to compile and test the smart contract, which is written in Solidity.



Sequence diagram

Algorithm 1

Input:manufacturerName, manufacturerEmailId, manufacturerPhone, manufacturerPassword, role.
Output: An event declaring that the manufacturer is added and generated an id.

Start:
Import an account in metamask using a private key from the ganache.
Call addManufacturer () function with the above-given input parameters.
Then
Increment the manufacturer count
update manufacturerName
update manufacturerEmailId
update manufacturerPhone
update manufacturerPassword
update role
update address (the account address from which the smart contract is triggered)
update isManufacturerLoggedIn = false;
Event declaring that the manufacturer is added and an id has been generated.
End;

Creating an Account for Manufacturer

In algorithm 1 the **addManufacturer()**function is used to add the manufacturer's account to the decentralized application with the specific inputs mentioned abovein the blockchain.

Similarly, addWholesaler(), addDistributor(), addPharmacy(), and addCustomer() functions are used in algorithm 1 to create an account for wholesaler, distributor, pharmacy, and customer accounts respectively by changing the variable name of the functions as per the requirement.

manufacturerName: is the name of the manufacturer.

manufacturerEmailId: is the email id of the manufacturer.

manufacturerPhone: is the phone number of the manufacturer.

manufacturerPassword: is the password of the manufacturer's account.

Algorithm 2

```
Input: manufacturerId, manufacturerPassword
Output: An event declaring userLoginStatus.
Start:
    Call login() function with the parameters namely manufacturerId and manufacturerPassword.
    If a manufacturer with the following id exists then
        If((manufacturerId == manufacturer[manufacturerId]. manufacturerId) &&
        (manufacturerPassword == manufacturer[manufacturerId].manufacturerPassword) &&
        (manufacturer[_manufacturerId], manufacturerAddress == msg.sender))
            Update isManufacturerLoggedIn= true;
            An event declaring the login status with the value true.
        else
            An event declaring the login status with value false.
    else
        Revert contract state and show an error.
End;
```

Manufacturer Login into the Decentralized Application.

In algorithm 2, the login() function is used for the user credentials verification before login into the application.

Similarly, the login() function for wholesaler, distributor, pharmacy, and customer also follows the above-given algorithm flow just with the change in the variable names and function names.

manufacturerId: is the unique id used for decentralized applications.

manufacturerPassword: is the password used for authentication purposes.

Algorithm 3

```
Input: manufacturerId, medicinePrefix, medicineName, medicineDescription, medicinePrice,medicineExpiryDate
Output: An event declaring medicine added
Start:
    Increment medicine count
    Update ownerId
    Update ownerAddress(the account from which the smart contract is being called)
    Update medicinePrefix
    Update medicineId = medicineCount
    Update medicineName
    Update medicineDescription
    Update medicinePrice
    Update medicineExpiryDate
    UpadtemedicineState =ManufacturedAndForSale;(medicine state represents the state of medicine at a particular instance
    of time in the supply chain network).
    Call createMedicineHistoryRecord function
    Emit an event declaring the successful addition of medicine
End;
```

Add Medicine.

In algorithm 3,addMedicine()function is used to add medicines to the supply chain management decentralized application.

Which is further called the createMedicineHistoryRecord() function to add a medicine record and mark the beginning of the medicine life cycle into the chain.Only manufacturers can add medicines.

medicinePrefix: is the unique medicine id prefix that is generated by the javascript.

medicineName: is the name of the medicine to be added.

medicineDescription: this is a short description of the medicine.

medicinePrice: is the price associated with the medicine.

medicineExpiryDate: is the medicine expire date.

Algorithm 4

Input: sellerId, buyerId, medicineId, solDate, newPrice, currentStatusCode, updatedStatusCode.

Output: An event declaring that the medicine has been Purchased.

Start:

- If medicine with the following id exist then
  - If seller id == medicineOwnerId then
    - If the buyer has enough ethers to buy the medicine, then
      - Update the medicineOwnerId
      - Update the ownerAddress
      - Transfer funds from buyer account to seller account
      - Update the medcinePrice to newPrice
      - Update the status code of the medicine based upon the current status code and the expected status code and call the create MedicineHistoryRecord function to record the purchase of medicine into the decentralized application for further use.
      - Emit an event declaring the purchase of medicine
    - else
      - Revert contract state and show an error.
  - else
    - Revert contract state and show an error.
- else
  - Revert contract state and show error

End;

Purchasing a Medicine

In algorithm 4,purchaseMedicine()function is used to make the purchase of medicine and record it into the decentralized application.Every stakeholder follows algorithm 4 to buy medicine in the application.

sellerId: is the unique id of the seller of the medicine.

buyerId: is the unique id of the buyer of the medicine.

medicineId: is the id associated with a particular medicine.

solDate: is the date on which the purchase is being made.

newPrice: is the updated price or the expected new price after the state change of medicine.

currentStatusCode: is the status code associated with the current state of medicine.

updatedStatusCode: is the expected change in the state of the medicine once the medicine is being bought by a particular stakeholder.

Algorithm 5

Input: ownerId

Output: An event declaring log-out status (true or false).

Start:

If an owner with the following id exists then

Update logged-in status to false

Declaring an event that the user logged out

else

Revert contract state and show an error.

End;

Logout from the System

In algorithm 5, the logout () function is used to change the status of the owner of the account to log out and thus exit from the decentralized application.

Logout for wholesaler, distributor, pharmacy, and customer also follow algorithm 5 just with the change in the variable name.

ownerId: is the id of the stakeholder currently logged in into the system.

Testing And Validation:

addManufacturer():

In algorithm 1 the **addManufacturer()**function is used to add the manufacturer's account to the decentralized application with the specific inputs mentioned abovein the blockchain.

Similarly, addWholesaler(), addDistributor(), addPharmacy(), and addCustomer() functions are used in algorithm 1 to create an account for wholesaler, distributor, pharmacy, and customer accounts respectively by changing the variable name of the functions as per the requirement.

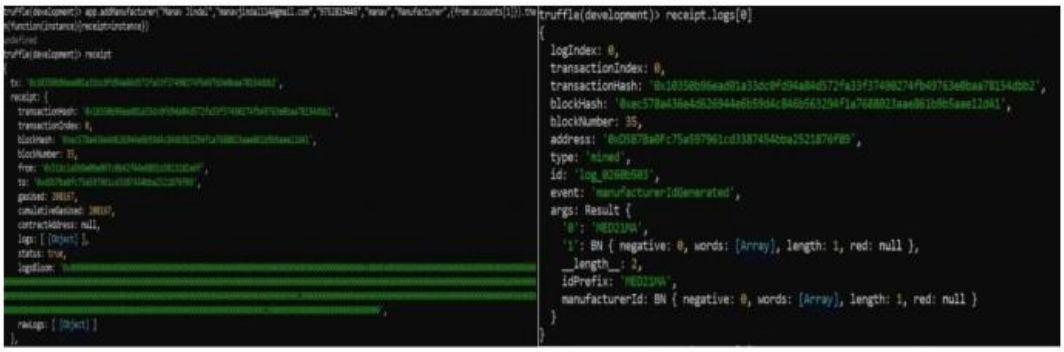
manufacturerName: is the name of the manufacturer.

manufacturerEmailId: is the email id of the manufacturer.

manufacturerPhone: is the phone number of the manufacturer.

manufacturerPassword: is the password of the manufacturer's account.

Fig. 3

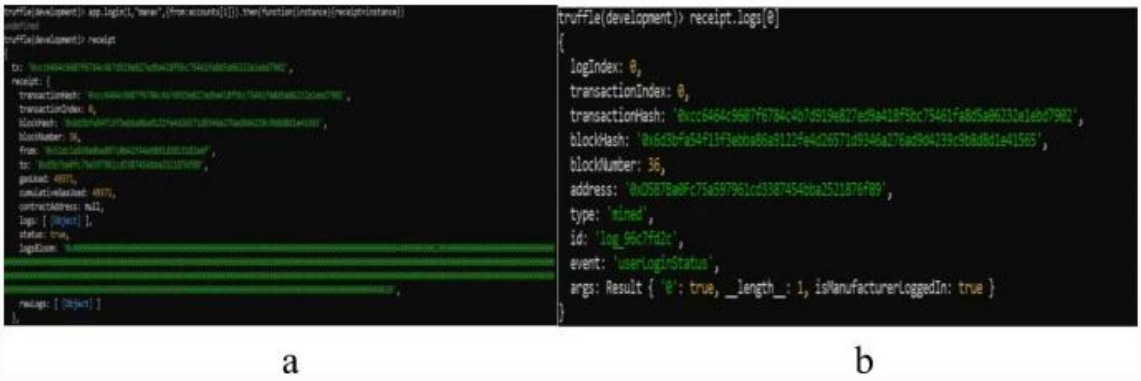


addManufacturer() execution (**a**) and log generation (**b**)

Similarly **addWholesaler(), addDistributer(), addPharmacy() and addCustomer()** are tested if a stakeholder is able to create an account with the respective role.

Login(): This function is used to login stakeholders into the decentralized system. Once the function gets executed without any error an event is triggered displaying the successful execution of the function.
Here we have displayed the login activity of the manufacturer with the successful execution of the function and its corresponding logs and events in Figs. 4a and b respectively.

Fig. 4

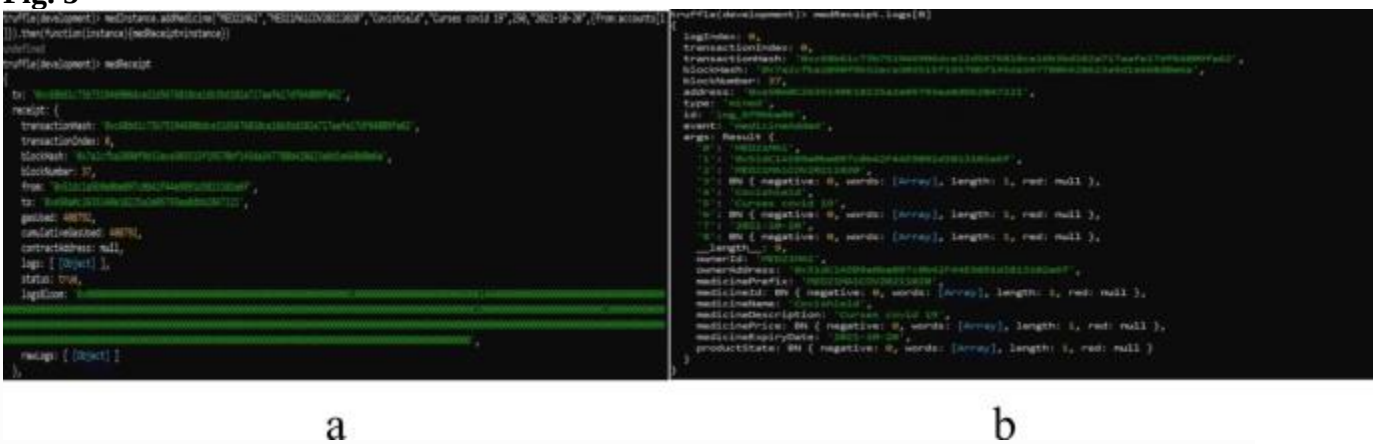


Login() execution (**a**) and log generation (**b**)

Similarly, the function will work for all the other stakeholders.

addMedicine(): This function is used by the manufacturer to add medicine to the decentralized application and to initiate the supply chain flow by marking the medicine for sale. If the medicine gets added without encountering any error,then an event is declared to all the participants of the chain the successful addition of the medicine else the state of the contract is reverted, and an error is thrown. Successful execution of the function and its corresponding logs and events are displayed in Figs. 5a and b respectively.

Fig. 5



addMedicine() execution (**a**) and log generation (**b**)

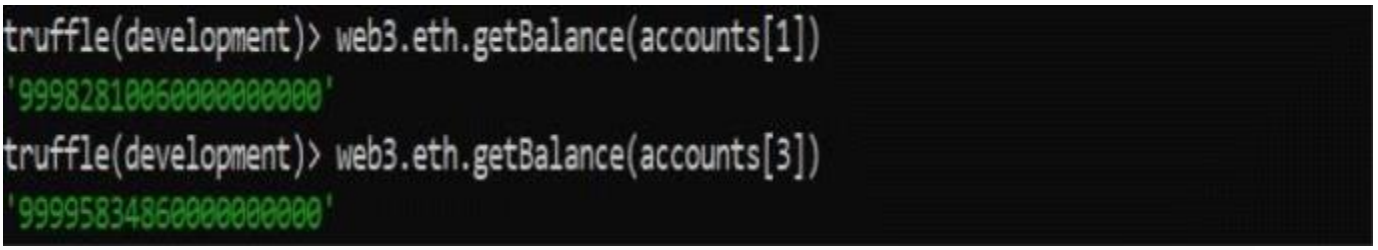
purchaseMedicine(): This function is used by the following stakeholders for the purchase of medicine either from the same level stakeholder or from the one just above them in the supply chain network.

When this function is called some specific checks are being made and the ownership of medicine is transferred to the new owner after the successful transfer of the fund.

At last, a record is being recorded in the history with the createMedicineHistoryRecord function and an event is declared.

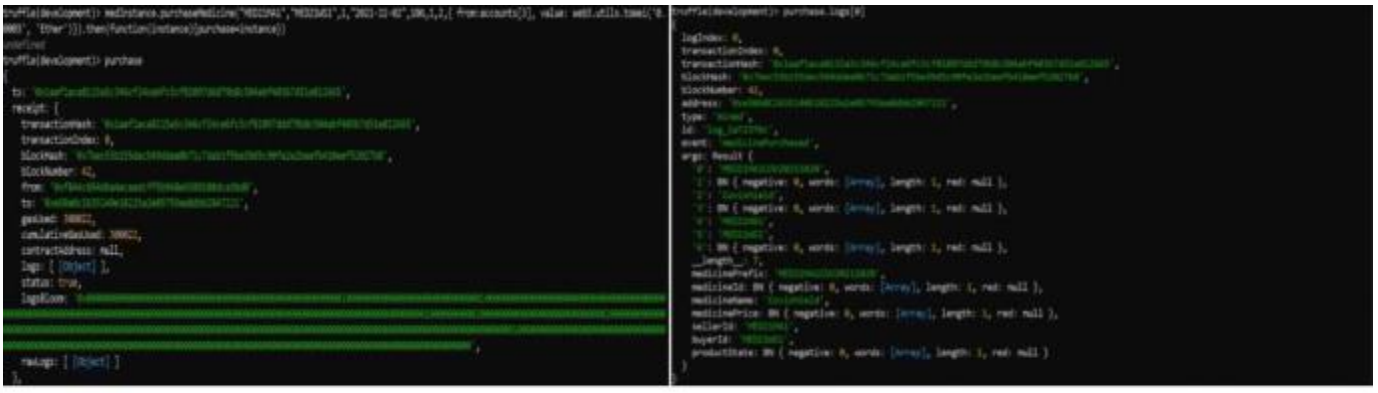
If by chance any security check fails then the contract state is reverted and an error is shown. especively.

Fig. 6



Manufacturer (accounts [38]) and wholesaler (accounts [29]) balance before purchase

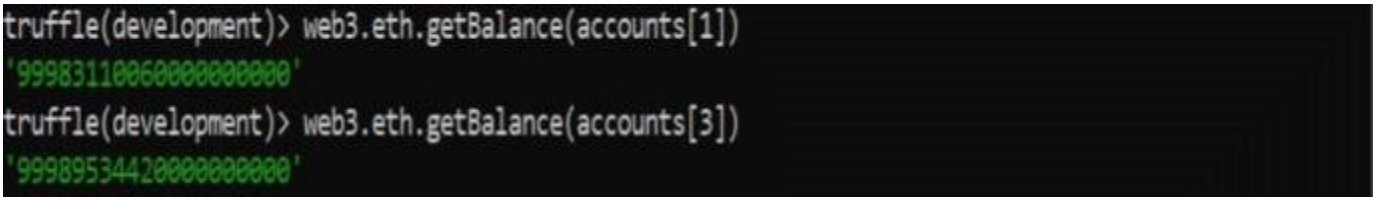
Fig. 7



a b

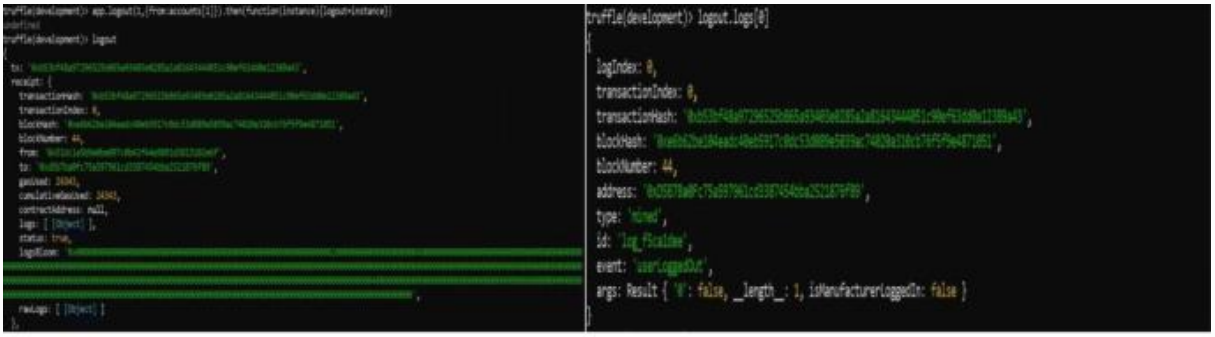
purchaseMedicine() execution (**a**) and log generation (**b**)

Fig. 8



Manufacturer (accounts(38)]) and wholesaler (accounts [29]) balance after purchase

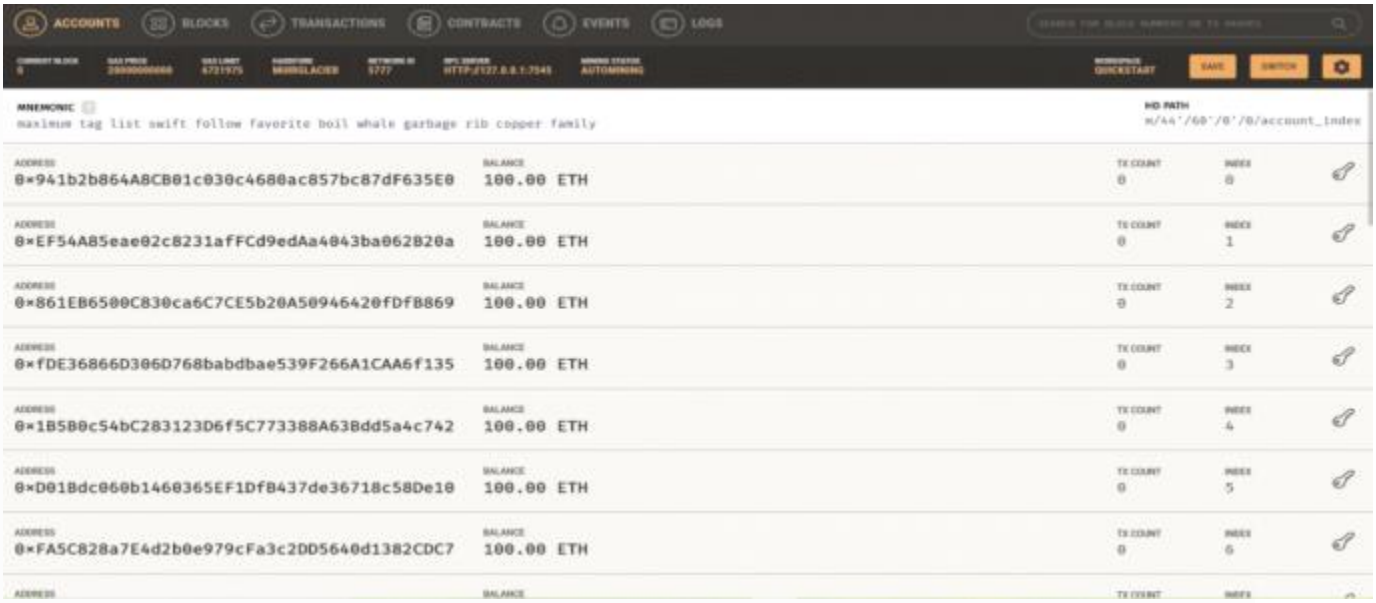
Fig 9



(a) (b)

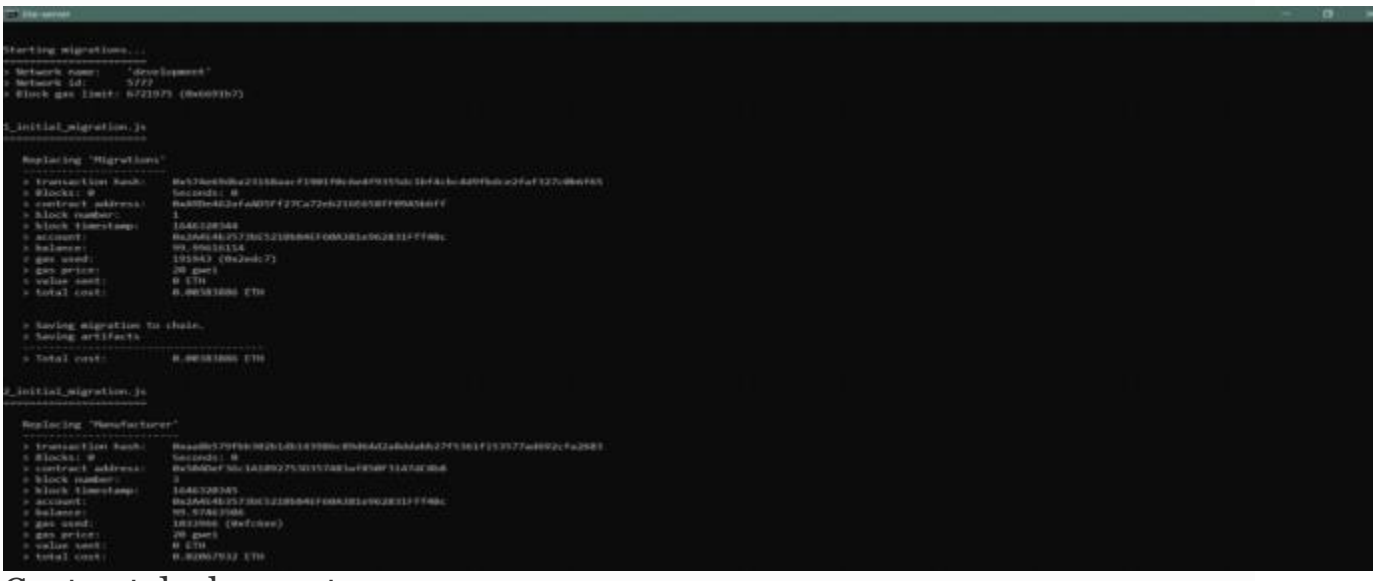
Logout execution (**a**) and log generation (**b)**

Fig. 10



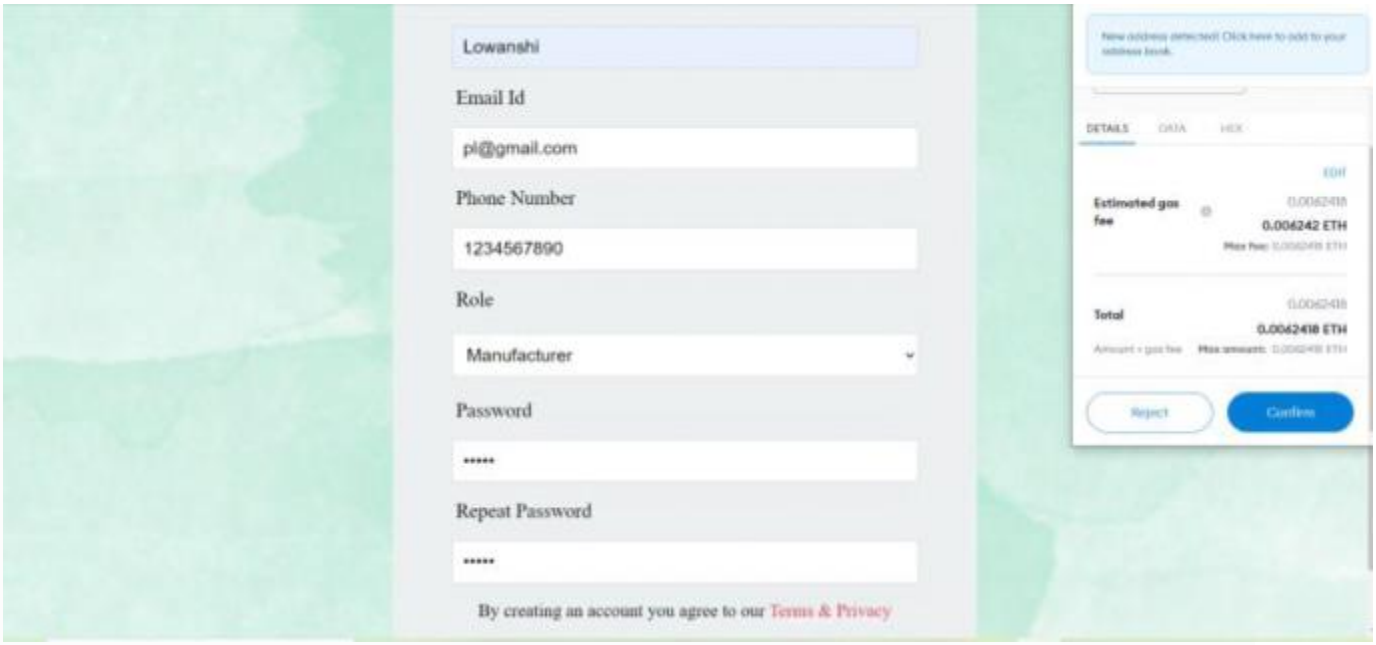
Ganache account

Fig. 11



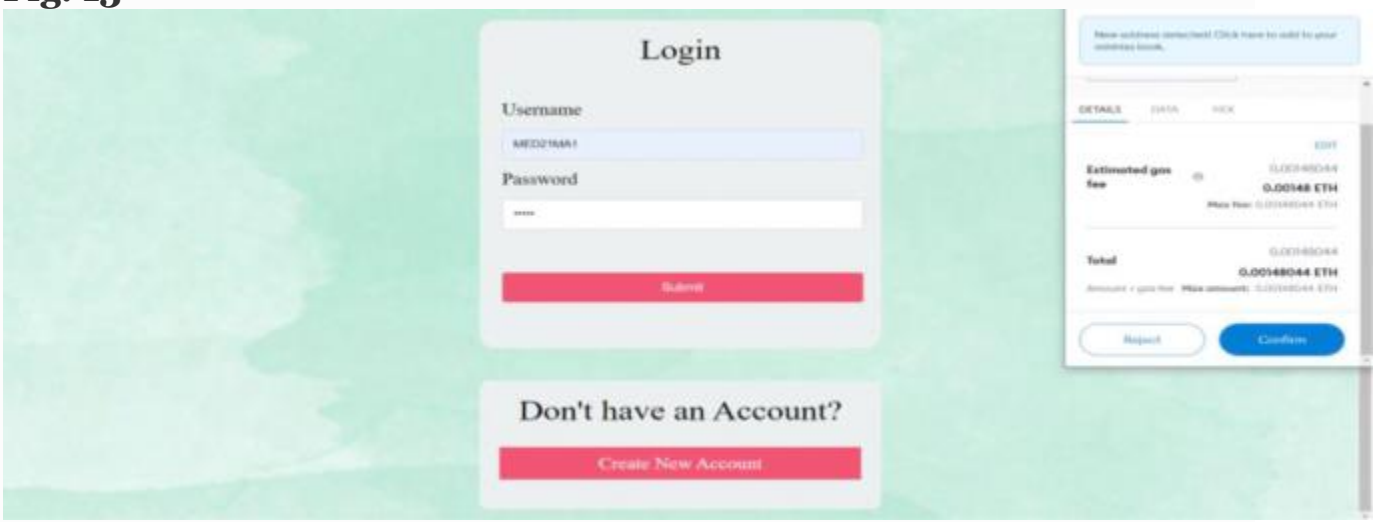
Contract deployment

Fig .12



Account creation

Fig. 13



Stake holder login

Fig. 14

Manufacturer add medicine

Fig. 15

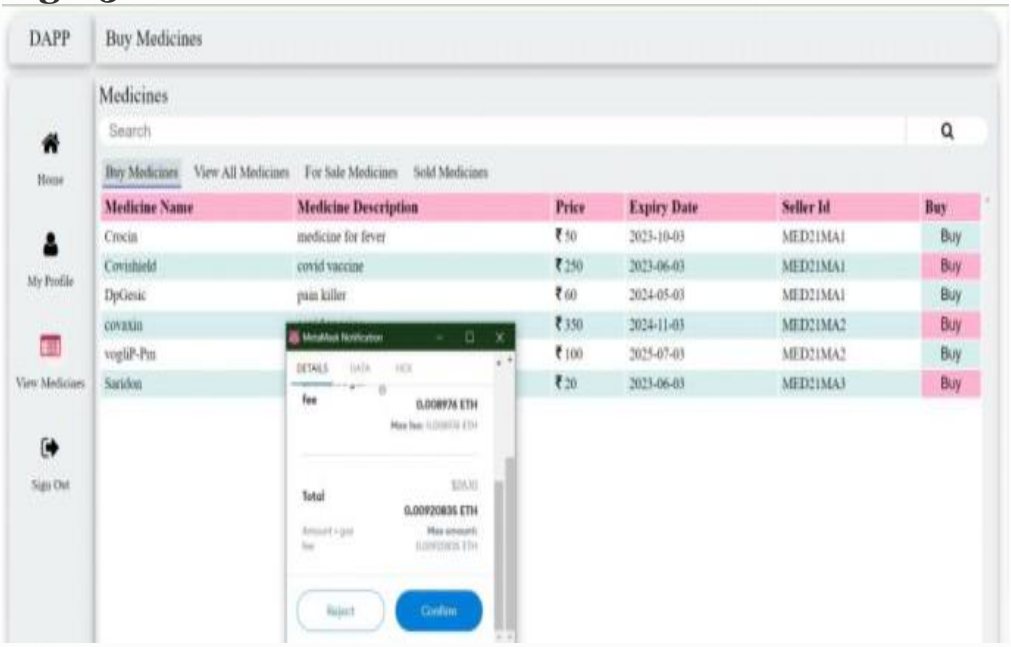
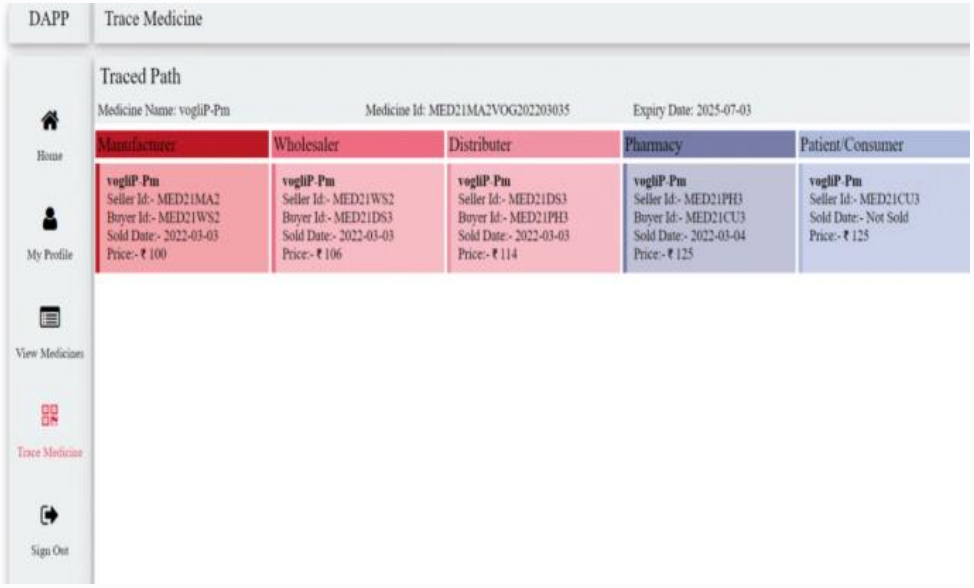


Fig. 16

Trace medicine window

Fig. 17



Full trace of medicine

logout: This function is used to log out users from the decentralized application and change status to logged out. Once the function gets executed without any error an event is triggered displaying the successful execution of the function

. Successful execution of the function and its corresponding logs and events are displayed in Figs. 9a and b respectively.