

WELCOME TO THE DECENTRALIZED PHARMACEUTICAL SUPPLY CHAIN

INTRODUCTION →

We at Dragonfly are thrilled to present our innovative prototype for pharmaceutical supply chain management. Our solution leverages the power of blockchain and web development to ensure the authenticity and traceability of drugs through a sophisticated system of QR codes and cryptographic keys. Additionally, our prototype tracks the environmental conditions, such as temperature and humidity, that the drugs experience during transit, using simulated IoT data.

For demonstration purposes, we have utilized a script to generate random temperature and humidity data, providing an interface to monitor these conditions. In a real-world application, this script could be replaced by actual IoT sensors, hardware, and oracle technologies to seamlessly integrate off-chain data with the blockchain.

Our supply chain model is designed to reflect real-world scenarios by managing drug transfers in batches (Collections of identical drugs) rather than individual units. This approach mirrors practical practices, as drugs are typically transferred in bulk from one stakeholder to another, rather than in single units.

To keep the prototype focused and manageable, we have excluded monetary transactions from the smart contract. Instead, our system highlights the drug transfer process in a simplified yet unique manner.

We hope you find our prototype insightful and appreciate the innovation behind our approach.

FILE MANAGEMENT →

Now introducing our whole file management process with important files and folders -

medKART Folder :

1. frontend Folder :

- **migrations Folder:** Contains migration scripts for smart contracts.
- **node_modules Folder:** Includes all dependencies for the frontend project.
- **public Folder:** Stores static files such as images and other assets.
- **src Folder:**
 - **components Folder:** Contains React components for the frontend.
 - **contracts Folder:** Houses smart contracts.
 - **truffle_abis Folder:** Contains JSON files for smart contract ABI after compilation.
 - **App.jsx:** Manages frontend routing and main application setup.
- **truffle-config.js:** Configuration file for connecting to the local Ethereum environment (e.g., Ganache).
- **iot.js:** Script for manual IoT interactions.
- **package.json:** Defines frontend dependencies and scripts.
- **package-lock.json:** Locks the frontend dependencies to specific versions.

2. backend Folder :

- **config Folder:** Contains database connection details and configuration.

- **controllers Folder:** Contains code for handling API requests and business logic.
- **middlewares Folder:** Includes middleware for request validation and processing.
- **models Folder:** Defines database schemas and models.
- **node_modules Folder:** Includes all dependencies for the backend project.
- **routes Folder:** Contains route definitions and handlers.
- **utils Folder:**
 - **zod.js:** Validation details using Zod.
 - **jwt.js:** JWT authentication and validation utilities.
- **.env:** Contains sensitive environment variables, including secret keys and Mongoose connection URL.
- **package.json:** Defines backend dependencies and scripts.
- **package-lock.json:** Locks the backend dependencies to specific versions.
- **server.js:** Sets up the server, initializes routes, and connects to the database.

3. output Folder :

- Stores output images and related files.

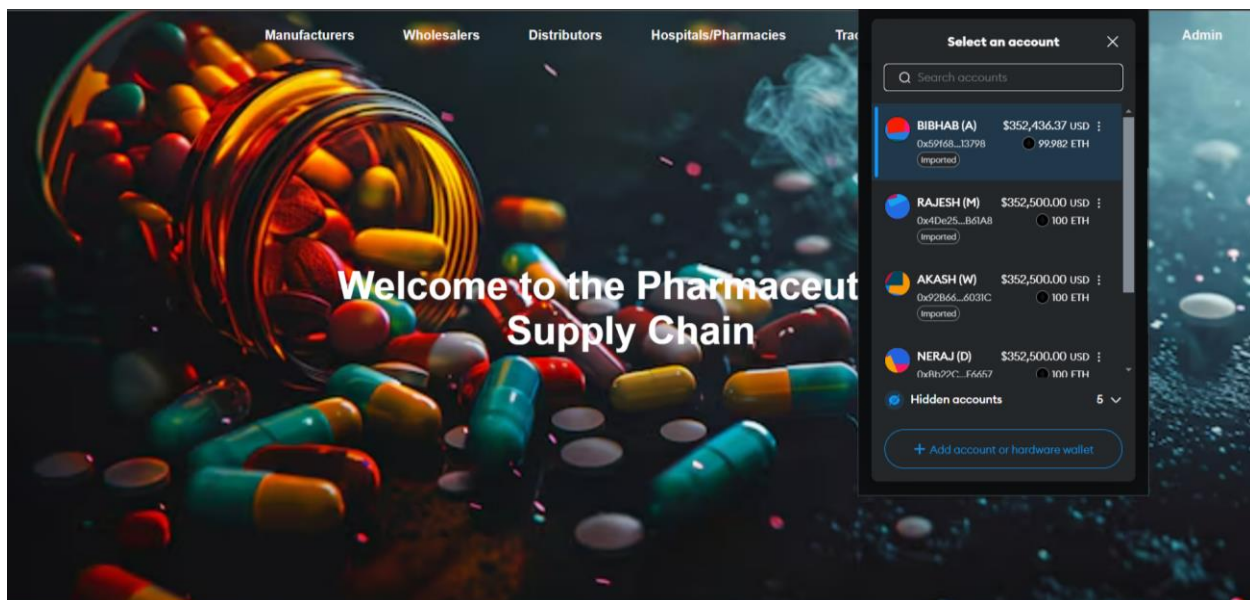
4. documentation File :

- Contains documentation for the project.

PROTOTYPE →

In this section, we will explore the complete supply chain process through detailed explanations and output photos. We will also illustrate how specific components and files contributed to the development of each page, providing a comprehensive overview of their roles and functionalities. Additionally, all routes used within the application are defined in the **App.jsx** file, ensuring clear routing management across the frontend –

1) MAIN HOME PAGE



This is the first page or the landing page of our website. The code of this page is handled in **Home.jsx** file of the components folder. Here I opened the Metamask extension and uploaded the accounts from local Ganache environment for further processing of my website. Now it is the duty of every stakeholder to go and register themselves and send a request message to the admin(BIBHAB) of the supply chain so that they can become a part of the supply chain. Since I am using local Ganache environment so by default my 1st account is the admin account as the deployment of the smart contracts occurred from the first account which is named as BIBHAB(A) on the metamask.

2) REGISTRATION PAGE

Register

Name:

Address:

Email:

Mobile Number:

Username:

Password:

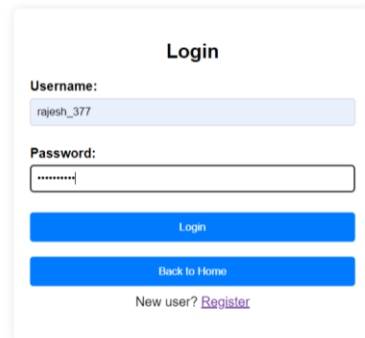
Confirm Password:

[Register](#)

Already have an account? [Login here](#)

So this is the registration page for each and every stakeholder of the supply chain. On clicking respective buttons (Manufacturers/ Wholesalers/ Distributors/ Hospitals/Pharmacies) on the landing page if the user is not preregistered to any metamask account and using that account to open the respective stakeholder page then he/she will get landed to a login page where they will be asked to register if they are new user. So here on the register form they need to enter their details and register themselves for the supply chain. The registration page for manufacturers, wholesalers, distributors and hospitals/pharmacies is coded in **Register1.jsx, Register2.jsx, Register3.jsx and Register4.jsx** respectively. The admin should also register himself if he uses the supply chain for the first time and his registering process is coded at **Register6.jsx** . All these register files are present inside the components folder. Once each of them registered there details gets stored inside the centralised MongoDB database which stores information that are not related to the main supply chain.

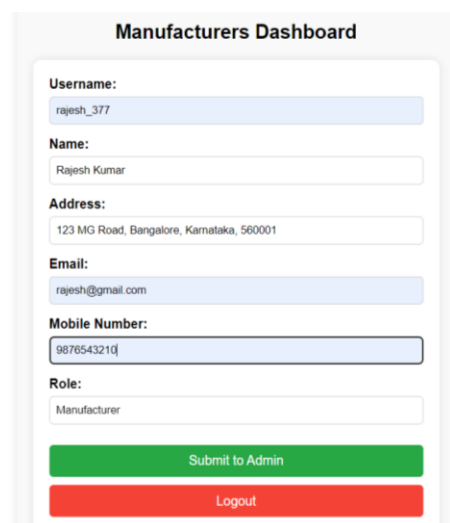
3) LOGIN PAGE



The image shows a login form titled "Login". It contains two input fields: "Username:" with the value "rajesh_377" and "Password:" with masked characters "*****". Below the password field are two blue buttons: "Login" and "Back to Home". At the bottom, there is a link "New user? [Register](#)".

Once the user registers himself/herself he/she will get redirected to this login page where they need to login with their details to enter the respective stakeholder dashboard page. The code for login page are written on Login1.jsx, **Login2.jsx, Login3.jsx, Login4.jsx and Login6.jsx** files for Manufacturers, Wholesalers, Distributors, Hospitals/Pharmacies and Admin respectively inside the components folder.

4) DASHBOARD PAGE



The image shows a form titled "Manufacturers Dashboard". It contains several input fields: "Username:" (rajesh_377), "Name:" (Rajesh Kumar), "Address:" (123 MG Road, Bangalore, Karnataka, 560001), "Email:" (rajesh@gmail.com), "Mobile Number:" (9876543210), and "Role:" (Manufacturer). At the bottom, there are two buttons: a green "Submit to Admin" button and a red "Logout" button.

This is the dashboard page for the manufacturer. Similar dashboard pages are also there for remaining stakeholders which you can see from the output folder. The dashboard codes are written on **DashBoard1.jsx, DashBoard2.jsx, DashBoard3.jsx and DashBoard4.jsx** inside the components folder for manufacturers, wholesalers, distributors and hospitals/pharmacies respectively. If a user doesnot have any account from beforehand on clicking the login button they will get redirected to this dashboard page which will ask for the details of the user and on submitting this form from frontend a request will go the admin to accept the user as a part of the supply chain.

Manufacturers Dashboard

Your submission is pending approval. Please wait for further instructions.

Account Number: Not assigned yet

Logout

If the request of a particular user is still not accepted by the admin this page will come on dashboard when that user will again log in.

Pending Requests

Register Manufacturer

Register Wholesaler

Register Distributor

Register Hospital/Pharmacy

Logout

Admin Dashboard

Welcome to the admin dashboard. Please select an option from the left panel.

Admin Details

Username: ben_177

Name: Bibhab Dasgupta

Email: bibhab9012004@gmail.com

Address: 129a BP Road, Kolkata, West Bengal, 700063

Mobile Number: 9330377736

Now let us accept the request of our manufacturer. When the admin logs in with his credentials he will get his dashboard which I quite different from the dashboard of the other users. The code for dashboard page of admin is coded inside **adminDashboard.jsx** file inside the components folder. The admin page has 4 routes for registering the stakeholders, 1 route to get pending requests and a logout route. All these routes are handled inside **Admin.jsx** file of the components folder. Now let us see the pending requests made to the admin by the stakeholders by going to Pending Requests route.

Pending Requests						
Username	Name	Address	Email	Mobile Number	Role	Send Account Number
rajesh_377	Rajesh Kumar	123 MG Road, Bangalore, Karnataka, 560001	rajesh@gmail.com	9876543210	Manufacturer	<button>Send Account Number</button>
akash_915	Akash Sharma	456 Park Street, Kolkata, West Bengal, 700016	akash@gmail.com	9123456789	Wholesaler	<button>Send Account Number</button>
neraj_333	Neraj Chopra	789 Nehru Nagar, Mumbai, Maharashtra, 400013	neraj@gmail.com	9987654321	Distributor	<button>Send Account Number</button>
prerna_275	Prerna Mehta	101 Jubilee Hills, Hyderabad, Telangana, 500033	prerna@gmail.com	9876512345	Hospital/Pharmacy	<button>Send Account Number</button>

So these are the pending requests. Let the admin decided to register the manufacturer then he will go the register manufacturer route to register the manufacturer.

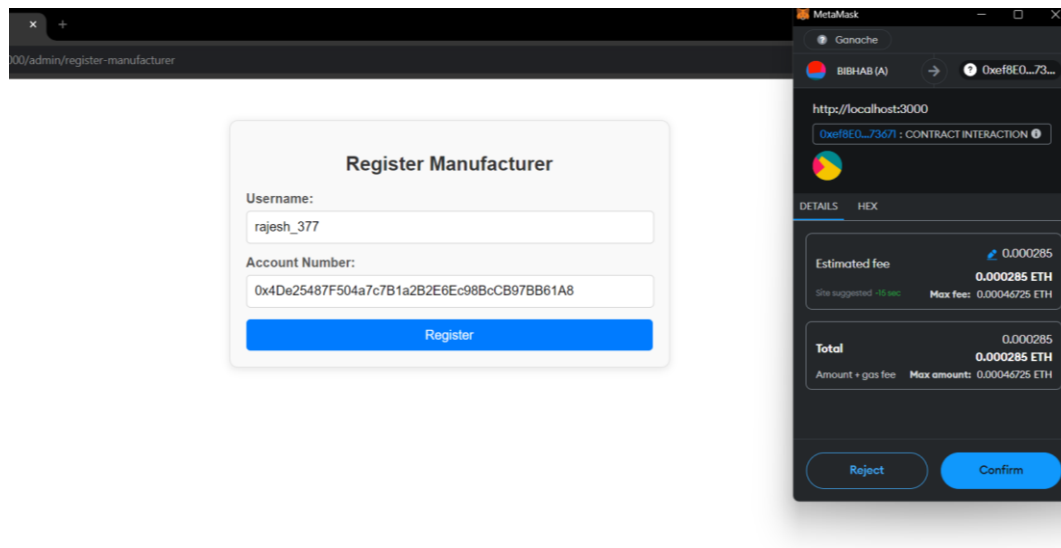
Register Manufacturer

Username:

Account Number:

Register

So here the admin will assign a account number to the manufacturer and register him/her with that account number which eventually gets stored in our PharmaChain smart contract inside the contracts folder.



Register Manufacturer

Username:

Account Number:

Register

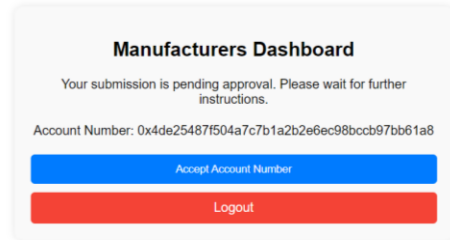
Manufacturer rajesh_377 registered with account number
0x4De25487F504a7c7B1a2B2E6Ec98BcCB97BB61A8

So congratulations!!! The manufacturer is finally registered with his unique account number.

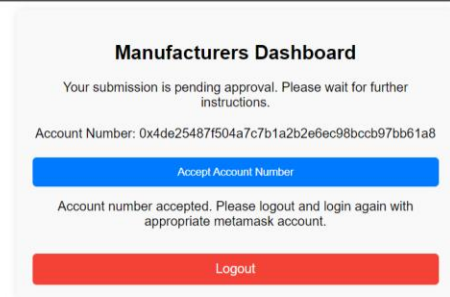
Pending Requests

Username	Name	Address	Email	Mobile Number	Role	Send Account Number
rajesh_377	Rajesh Kumar	123 MG Road, Bangalore, Karnataka, 560001	rajesh@gmail.com	9876543210	Manufacturer	<button>Send Account Number</button>
<input type="text" value="0x4De25487F504a7c7B1a2B2E6Ec98BcCB97BB61A8"/>						<button>Send</button>
akash_915	Akash Sharma	456 Park Street, Kolkata, West Bengal, 700016	akash@gmail.com	9123456789	Wholesaler	<button>Send Account Number</button>
neraj_333	Neraj Chopra	789 Nehru Nagar, Mumbai, Maharashtra, 400013	neraj@gmail.com	9987654321	Distributor	<button>Send Account Number</button>
prerna_275	Prerna Mehta	101 Jubilee Hills, Hyderabad, Telangana, 500033	prerna@gmail.com	9876512345	Hospital/Pharmacy	<button>Send Account Number</button>

After registering the admin will send back the account number to the manufacturer which the manufacturer will get on his dashboard.



So as a final step the manufacturer need to accept his account number to be a permanent member of this beautiful supply chain.



So after accepting his account number he/she has to logout and login again with his own account number from metamask to fetch his page.

One important thing to note is that in this documentation we showed only the example of how the manufacturer will become the part of the supply chain. The same procedure will follow for all other stakeholders of the supply chain and the necessary output pictures for all stakeholders are present inside the outputs folder.

The **Manufacturers.jsx**, **Wholesalers.jsx**, **Distributors.jsx** and **HospitalsPharmacies.jsx** file inside the components folder contains all the essential logic related to the routing of the stakeholders. The **ManufacturerDetails.jsx**, **WholesalerDetails.jsx**, **DistributorDetails.jsx** and **HospitalPharmacyDetails.jsx** contain all the necessary codes for handling the

forms which the respective stakeholders need to submit to the admin so that the admin can accept them to be a part of the supply chain.

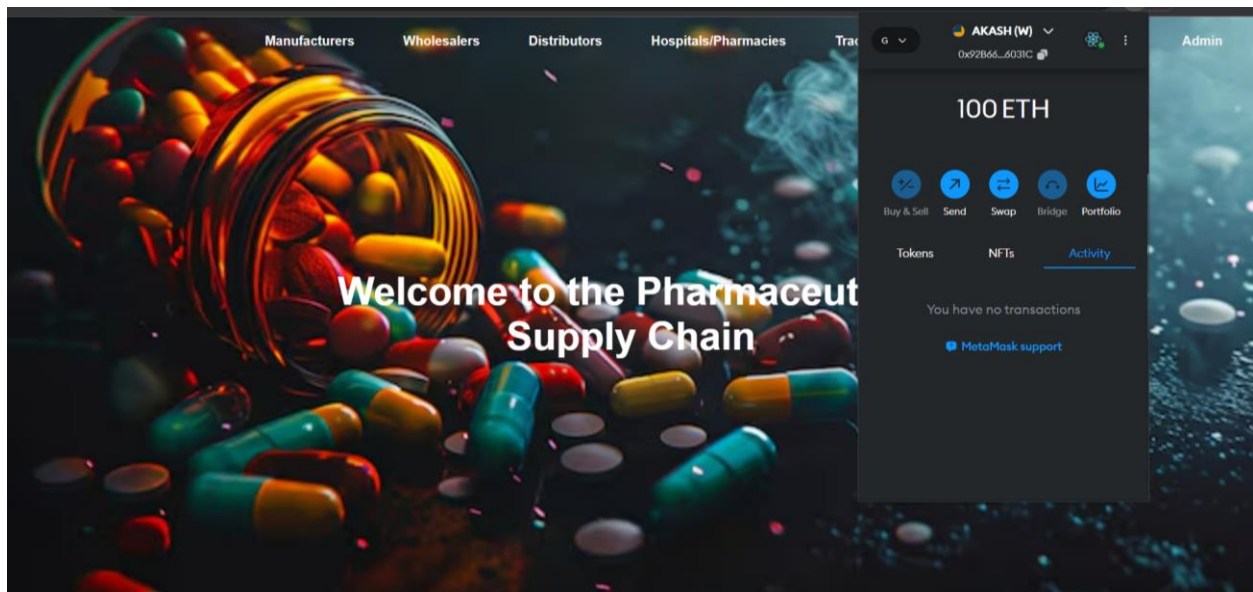
SO ALL THE STAKEHOLDERS HAVE SUCCESSFULLY REGISTERED THEMSELVES TO BE A PART OF THIS INNOVATIVE SUPPLY CHAIN. NOW LET'S MOVE ONE STEP FORWARD AND SEE HOW THE SUPPLY CHAIN ACTUALLY WORKS AS A WHOLE!!!

5) THE SUPPLY CHAIN

The whole supply chain is managed and controlled by the Drugs smart contract. We are doing to demonstrate the supply chain in 2 phases:

Phase 1 → The wholesaler asks for some batches of drugs from the manufacturer so that they can keep their stocks updated.

So for the 1st phase, the wholesaler logs into his account through metamask and then looks for the manufacturers he knows from the manufacturer list.



Note: The above picture shows how the wholesaler can navigate to his account using metamask. The same process is used for all the stakeholders to navigate to his/her account. So to keep the documentation precise we are not including the pictures of all the stakeholders navigating to his/her account. Although all the pictures related to this are available inside our output folder.

Home
Manufacturer List
Distributor List
Request Drugs
Pending Hospital/Pharmacy Requests
Pending Distributor Requests
My Drugs
Send Drugs
Logout

Account Details

Username: akash_915

Name: Akash Sharma

Address: 456 Park Street, Kolkata, West Bengal, 700016

Email: akash@gmail.com

Mobile Number: 9123456789

Role: Wholesaler

So after logging in the wholesaler reaches to his home page. The code of this page comes from **Home2.jsx** in the components folder. Now to fetch the manufacturers details he/she will go to the manufacturer list.

Home
Manufacturer List
Distributor List
Request Drugs
Pending Hospital/Pharmacy Requests
Pending Distributor Requests
My Drugs
Send Drugs
Logout

Manufacturer List

Username	Account	Name	Address	Email	Mobile Number
rajesh_377	0x4De25487F504a7c7B1a2B2E6Ec98BcCB97BB61A8	Rajesh Kumar	123 MG Road, Bangalore, Karnataka, 560001	rajesh@gmail.com	9876543210

Now after fetching the details of a manufacturer he can choose any manufacturer from the table (here only 1 is there but in reality the smart contract can store multiple manufacturers) and then he/she should go to the Request Drugs option to request a drug from the manufacturer.

React App
localhost:3000/wholesalers/home

Request Drugs

Drug Name:
Cefla

Quantity:
5

Manufacturer Address:
0x4De25487F504a7c7B1a2B2E6Ec98BcCB97BB61A8

Submit Request

MetaMask
AKASH (W) → 0xC5d2b...f...
http://localhost:3000
0xC5d2b...fAa56 CONTRACT INTERACTION

DETAILS HEX
Estimated fee 0.00040568
0.00040568 ETH
Site suggested -15 sec Max fee: 0.0005889 ETH
Total 0.00040568
0.00040568 ETH
Amount + gas fee Max amount: 0.0005889 ETH
Reject Confirm

The wholesaler fills the form with his necessary drugs, quantity of drugs he/she require and the manufacturer address from where he/she is expecting the drug batch to come.

localhost:3000 says
Request sent successfully

OK

Drug Name:

Quantity:

Manufacturer Address:

Submit Request

A success pop up comes after the wholesaler has successfully requested the drug. Now let us visit to the manufacturers home page to see whether he/she got the drug request.

Account Details

Username: rajesh_377

Name: Rajesh Kumar

Address: 123 MG Road, Bangalore, Karnataka, 560001

Email: rajesh@gmail.com

Mobile Number: 9876543210

Role: Manufacturer

So this is the manufacturers home page. The code of this page is written on **Home1.jsx** inside the components folder. Now lets navigate to the Pending Requests button to see the pending requests.

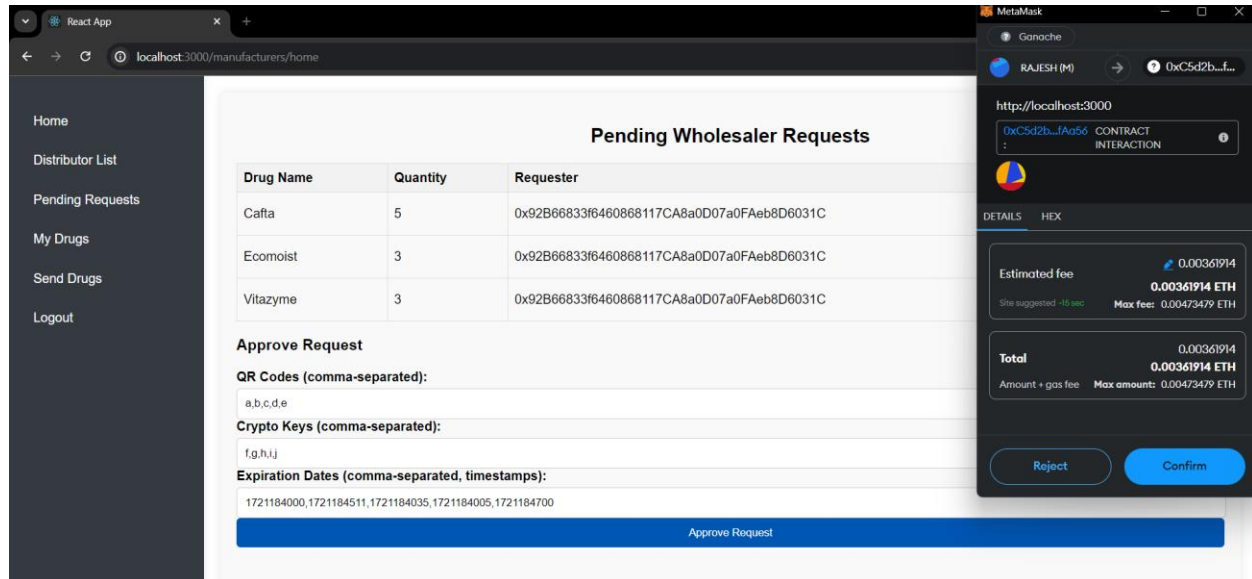
Pending Wholesaler Requests

Drug Name	Quantity	Requester	Approve
Cafta	5	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	<button>Approve</button>
Ecómoist	3	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	<button>Approve</button>
Vítazyme	3	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	<button>Approve</button>

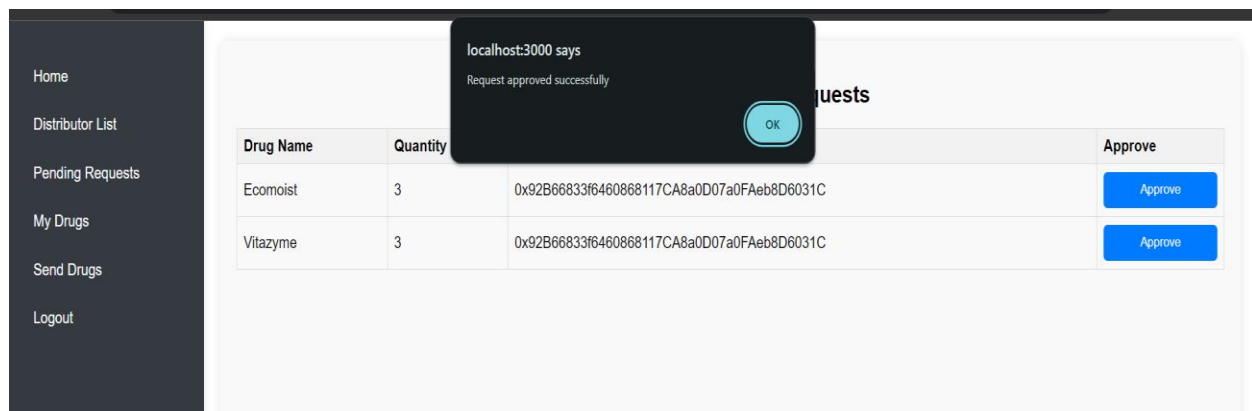
Note: The wholesaler made 2 more requests. The picture of those pages are included inside the output folder. For simplicity, we are showing based on one request.

Yay! The manufacturer got the requests from the wholesaler.

Now for approving the request made by the wholesaler, the manufacturer clicks the approve button.



On clicking the approve button, a form appears asking for necessary details about the drugs. Since the manufacturer is the emerging point of any transaction he/she has the right to provide the qr codes and cryptographic keys along with expiration date to his/her drugs. After providing the necessary details the manufacturer approves the request using metamask and a pop up comes with an accept message.



After approving the drug request the new drug/batch of identical drugs becomes a part of the supply chain and it initially gets stored on the my drugs page of the manufacturer because on approving the wholesaler request it is assumed that the manufacturer packed the drugs based on the wholesalers requests and gave it a unique batch id so that it can be tracked throughout the supply chain.

My Drugs						
Batch ID	QR Codes	Owner	Final Recipient		Quantity	Status
0	a, b, c, d, e	0x4De25487F504a7c7B1a2B2E6Ec98BcCB97BB61A8	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C		5	Manufactured
1	k, l, m	0x4De25487F504a7c7B1a2B2E6Ec98BcCB97BB61A8	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C		3	Manufactured

So the manufacturer created Batch ID 0 for the wholesaler request we are dealing with in this documentation.

Now the manufacturer should see the distributor list form the Distributor List button so that he/she can choose a suitable distributor for the transaction of the drugs from him/her to the wholesaler.

Distributor List					
Username	Account	Name	Address	Email	Mobile Number
neraj_333	0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657	Neraj Chopra	789 Nehru Nagar, Mumbai, Maharashtra, 400013	neraj@gmail.com	9987654321

Home

Distributor List

Pending Requests

My Drugs

Send Drugs

Logout

Send Drugs

Batch ID:

0

Distributor ID:

0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657

Send Drugs

Ganache

RAJESH (...)

0xC5d2b...

http://localhost:3000

0xC5d2b.../Aa56 CONTRACT INTERACTION

DETAILS

HEX

Estimated fee 0.00030954

0.00030954 ETH

Site suggested -16 sec

Max fees: 0.000321 ETH

Total 0.00030954

0.00030954 ETH

Amount + gas fee

Max amount: 0.000321 ETH

Reject

Confirm

After choosing a suitable distributor the manufacturer should navigate to the Send Drugs button and send a delivery request to the distributor. This transaction also goes through metamask and an alert is generated after the manufacturer confirms the transaction though metamask.

[Home](#)
[Distributor List](#)
[Pending Requests](#)
[My Drugs](#)
[Send Drugs](#)
[Logout](#)

localhost:3000 says
Transfer request created successfully

OK

Batch ID:

Distributor ID:

Send Drugs

Now lets go to the distributors home page (code written in **Home3.jsx** inside components folder) to see whether he/she got the delivery request or not.

[Home](#)
[Manufacturer List](#)
[Distributor List](#)
[Request Drugs](#)
[Pending Hospital/Pharmacy Requests](#)
[Pending Distributor Requests](#)
[My Drugs](#)
[Send Drugs](#)
[Logout](#)

Pending Distributor Requests

Request ID	Batch ID	Requester	Status	Actions
0	0	0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657	Pending	Approve

So the distributor got the delivery request which he/she need to approve so that the drug comes to him as an intermediary stakeholder.

[Home](#)
[Manufacturer List](#)
[Wholesaler List](#)
[Hospital/Pharmacy List](#)
[Pending Delivery Requests from Manufacturers](#)
[Pending Delivery Requests from Wolesalers](#)
[My Drugs](#)
[Send Drugs to Wholesalers](#)
[Send Drugs to Hospitals/Pharmacies](#)
[Logout](#)

My Drugs

Batch ID	Owner	Quantity	Final Recipient	Status
0	0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657	5	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	In Transit1
1	0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657	3	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	In Transit1

So the drugs with batch ID 0 which we are considering in our demonstration is now having the owner as the distributor at Transit 1 state because the ownership of the drug is now passed from the manufacturer to the distributor. The distributor also gets to know about the final recipient of the drug from the table. He checks whether the final recipient is a wholesaler or hospitals/pharmacies from the Wholesaler and Hospital/Pharmacy List.

Home

Manufacturer List

Wholesaler List

Hospital/Pharmacy List

Pending Delivery Requests from Manufacturers

Pending Delivery Requests from Wolesalers

My Drugs

Send Drugs to Wholesalers

Send Drugs to Hospitals/Pharmacies

Logout

Wholesaler List

Username	Account	Name	Address	Email	Mobile Number
akash_915	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	Akash Sharma	456 Park Street, Kolkata, West Bengal, 700016	akash@gmail.com	9123456789

Home

Manufacturer List

Wholesaler List

Hospital/Pharmacy List

Pending Delivery Requests from Manufacturers

Pending Delivery Requests from Wolesalers

My Drugs

Send Drugs to Wholesalers

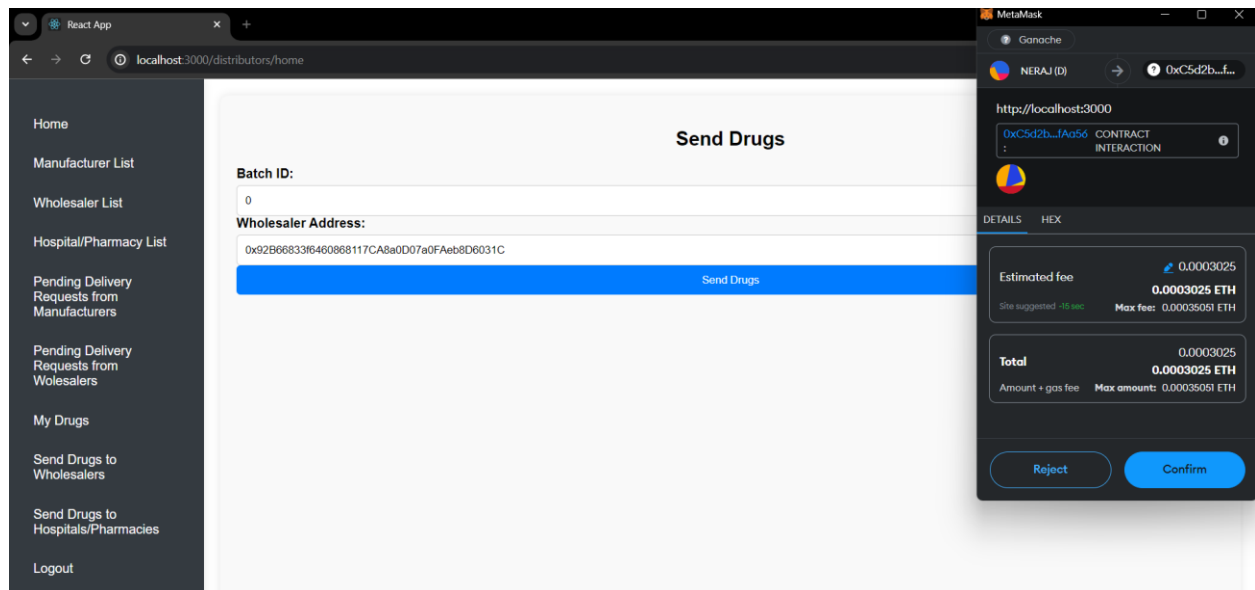
Send Drugs to Hospitals/Pharmacies

Logout

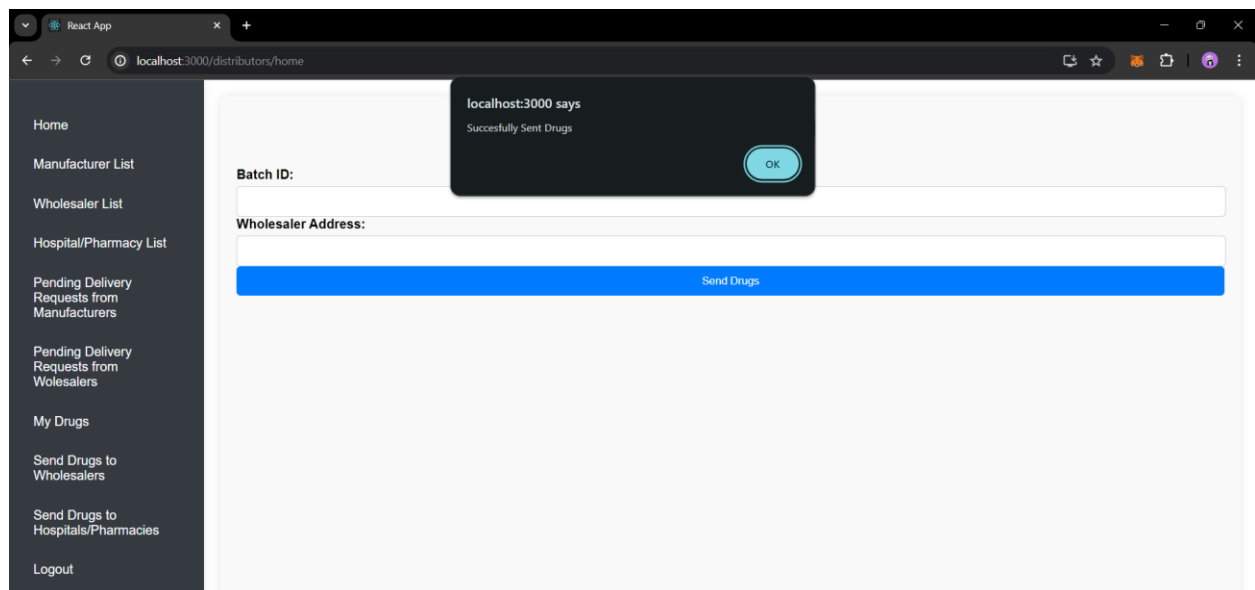
Hospital/Pharmacy List

Username	Account	Name	Address	Email	Mobile Number
prema_275	0x71192EB2A01e8E730050B250169e853Ee89cE1	Prerna Mehta	101 Jubilee Hills, Hyderabad, Telangana, 500033	prerna@gmail.com	9876512345

So now he proceeds for sending the drug to the appropriate recipient.



After clicking the confirm button on metamask the distributor finally sends a delivery request to the wholesaler.



Now let us check whether the wholesaler got the delivery request or not from the distributor.

Home

Manufacturer List

Distributor List

Request Drugs

Pending Hospital/Pharmacy Requests

Pending Distributor Requests

My Drugs

Send Drugs

Logout

Pending Distributor Requests

Request ID	Batch ID	Requester	Status	Actions
0	0	0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657	Pending	<div>Approve</div>

So, the pending distributor requests are successfully fetched by the wholesaler and on approving this request via metamask the wholesaler will finally get the drug/batch of drugs from the manufacturer via a distributor.

Home

Manufacturer List

Distributor List

Request Drugs

Pending Hospital/Pharmacy Requests

Pending Distributor Requests

My Drugs

Send Drugs

Logout

My Drugs

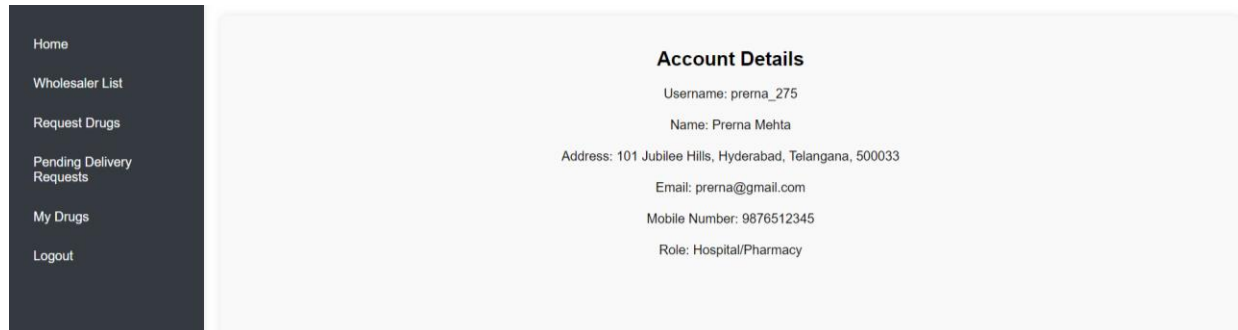
Batch ID	Owner	Quantity	Final Recipient	Status
0	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	5	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	Wholesaler
1	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	3	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	Wholesaler

So, the wholesaler finally got the batch of drugs (BatchID=0 which we are dealing with) from the manufacturer via a distributor. We can see that the owner and the final recipient of the drugs are same. So, we can conclude that the drugs reached their final destination.

So that's all about the first phase of our supply chain where we successfully sent the drugs to wholesalers from manufacturers based on their request via a distributor.

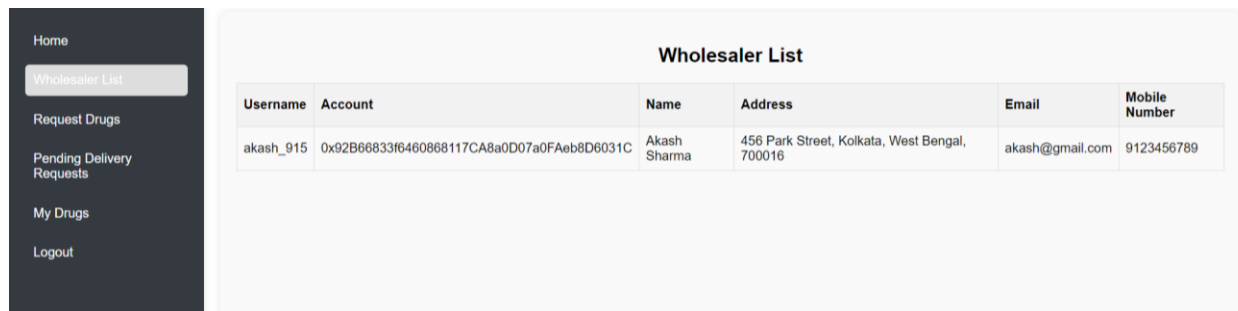
Phase 2 → The hospital asks for some batches of drugs from the wholesaler so that they can successfully treat their patients.

So for the 2nd phase, the hospital logs into his account through metamask and then looks for the wholesalers he/she knows from the wholesaler list.



The screenshot shows a web application interface. On the left is a dark sidebar with navigation links: Home, Wholesaler List, Request Drugs, Pending Delivery Requests, My Drugs, and Logout. The main content area is titled "Account Details" and displays the following information: Username: prema_275, Name: Prema Mehta, Address: 101 Jubilee Hills, Hyderabad, Telangana, 500033, Email: prema@gmail.com, Mobile Number: 9876512345, and Role: Hospital/Pharmacy.

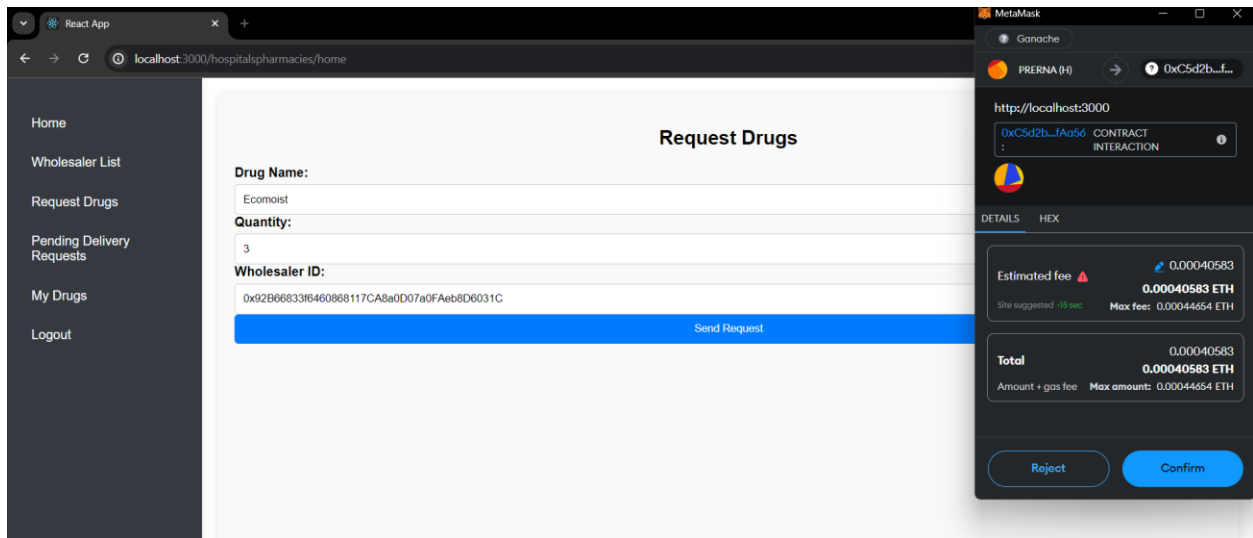
So after logging in the hospital reaches to his/her home page. The code of this page comes from **Home4.jsx** in the components folder. Now to fetch the wholesalers details he/she will go to the wholesaler list.



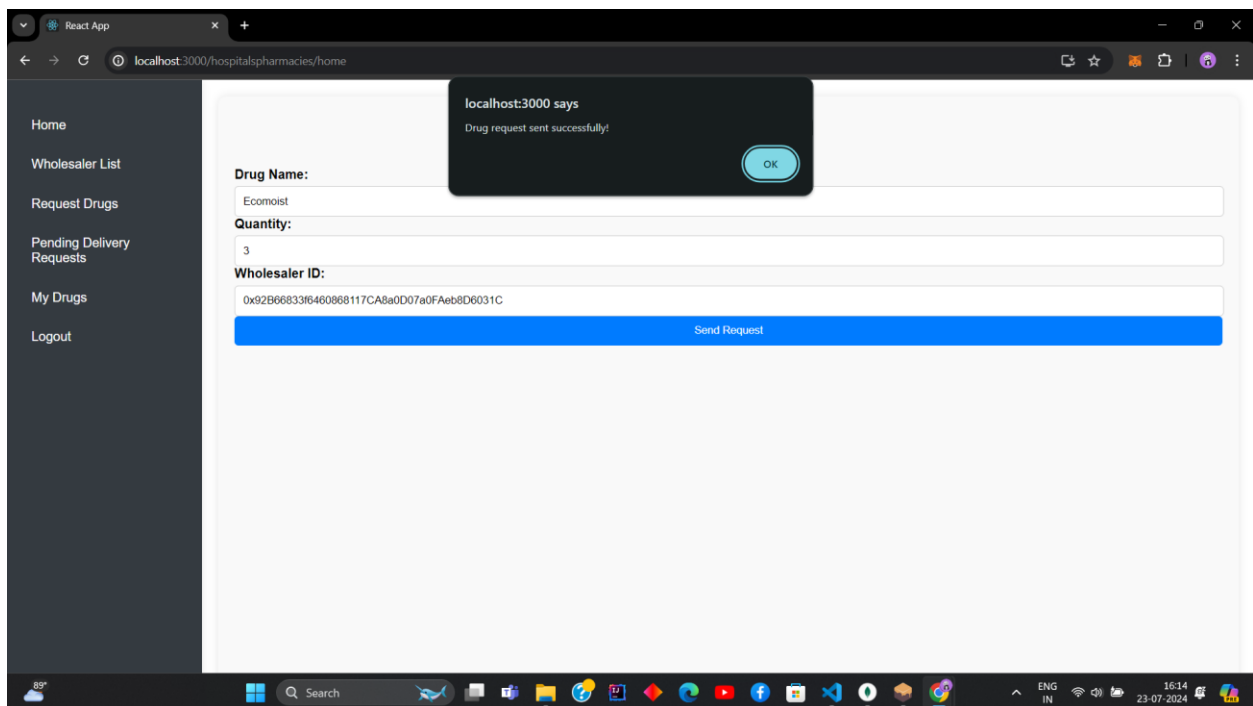
The screenshot shows the "Wholesaler List" page. The sidebar is the same as in the previous image, but the "Wholesaler List" link is highlighted. The main content area features a table with the following data:

Username	Account	Name	Address	Email	Mobile Number
akash_915	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	Akash Sharma	456 Park Street, Kolkata, West Bengal, 700016	akash@gmail.com	9123456789

Now after fetching the details of wholesalers he/she can choose any wholesaler from the table (here only 1 is there but in reality the smart contract can store multiple wholesalers) and then he/she should go to the Request Drugs option to request a drug from the wholesaler.



The hospital fills the form with his necessary drugs, quantity of drugs he/she require and the wholesaler address from where he/she is expecting the drug batch to come.



A success pop up comes after the hospital has successfully requested the drug. Now let us visit to the wholesalers home page to see whether he/she got the drug request.

Imp Note: For the phase 2 of the supply chain we are considering the batch with BatchID 1 and not the batch with BatchID 0 which we considered in phase 1. This situation may arise in a real life scenario where a wholesaler has various batches of drugs but the hospital need some specific drugs only. In maximum cases, wholesalers have a more stock than the hospitals/pharmacies.

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Pending Hospital/Pharmacy Requests

Request ID	Drug Name	Requester	Quantity	Status	Actions
0	Ecomist	0x71192EB2A01e8E1E730050B250169e853Ee89cE1	3	Pending	<div><div>Approve</div><div><input type="text" value="1"/></div><div>Submit</div></div>

Yay! The wholesaler got the requests from the hospital.

Now for approving the request made by the hospital, the wholesaler clicks the approve button which then asks for the BatchID the wholesaler is wanting to send to the hospital and on further clicking the submit button after setting a BatchID a metamask transaction occurs which finally approves the request of the hospital.

React App

localhost:3000/wholesalers/home

Home

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Distributor List

Request Drugs

Pending Hospital/Pharmacy Requests

Pending Distributor Requests

My Drugs

Send Drugs

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Pending Hospital/Pharmacy Requests

Request ID	Drug Name	Requester	Quantity	Status
0	Ecomist	0x71192EB2A01e8E1E730050B250169e853Ee89cE1	3	Pending

MetaMask

Ganache

AKASH (W) → 0xC5d2b...f...

http://localhost:3000

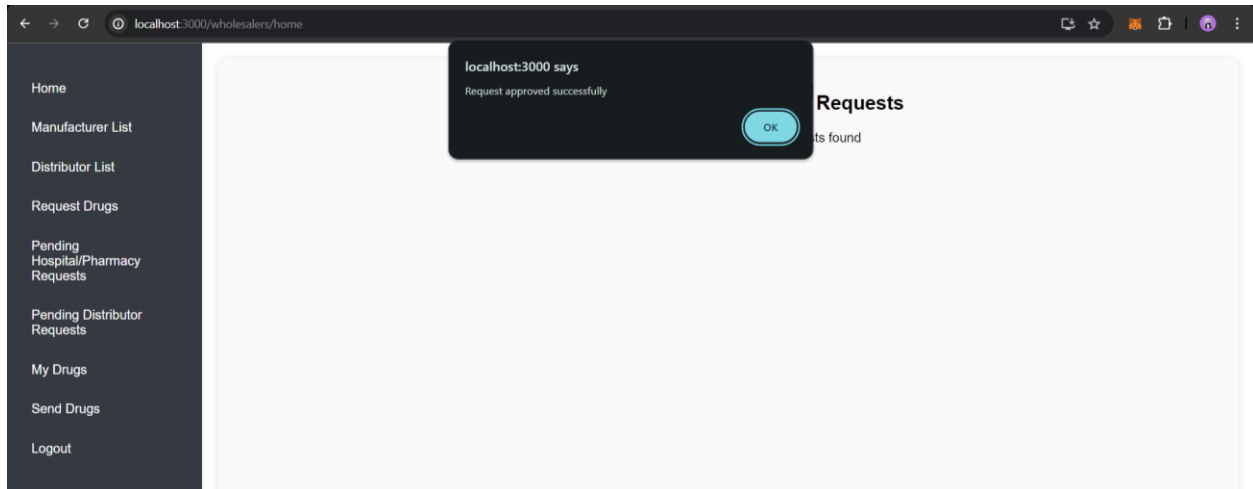
0xC5d2b...fA956 CONTRACT INTERACTION ⓘ

DETAILS HEX

Estimated fee 0.00010359
0.00010359 ETH
Site suggested 15 sec Max fee: 0.0001287 ETH

Total 0.00010359
0.00010359 ETH
Amount + gas fee Max amount: 0.0001287 ETH

Reject Confirm



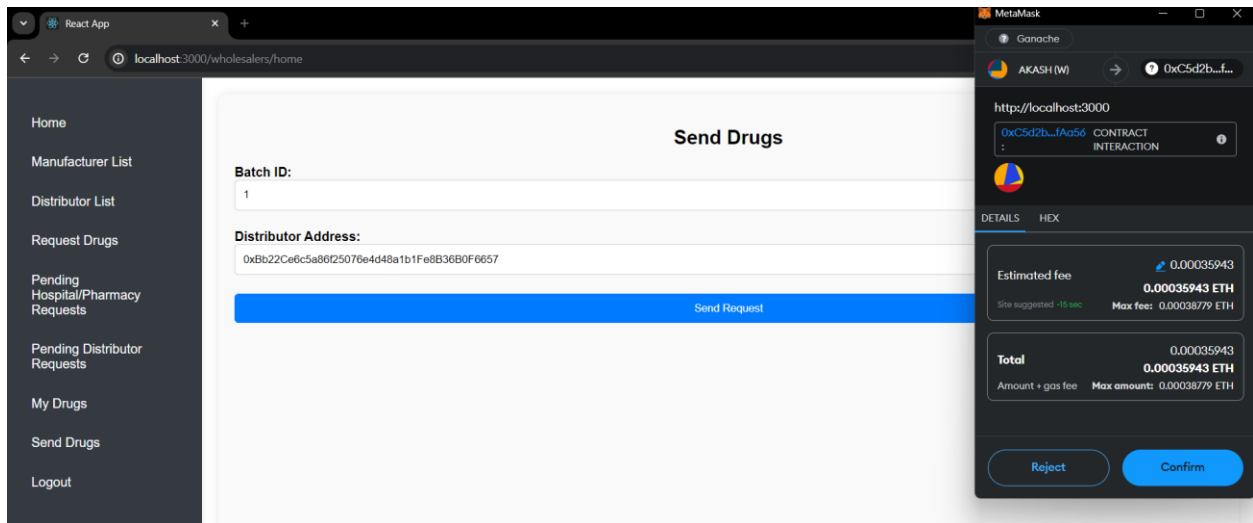
After approving the drug request a success alert appears on screen and the new drug/batch of identical drugs has its new final recipient as the hospital address.

My Drugs				
Batch ID	Owner	Quantity	Final Recipient	Status
0	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	5	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	Wholesaler
1	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	3	0x71192EB2A01e8E1E730050B250169e853Ee89cE1	Wholesaler

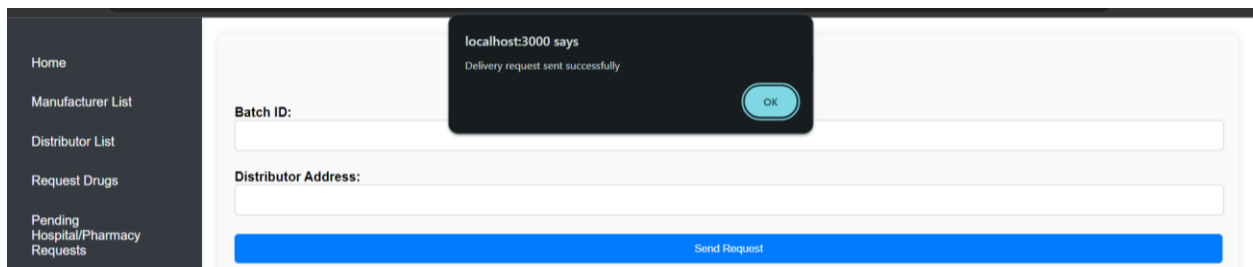
It can be seen here that the final recipient of the drug with BatchID 1 changed.

Now the wholesaler should see the distributor list from the Distributor List button so that he/she can choose a suitable distributor for the transaction of the drugs from him/her to the hospital.

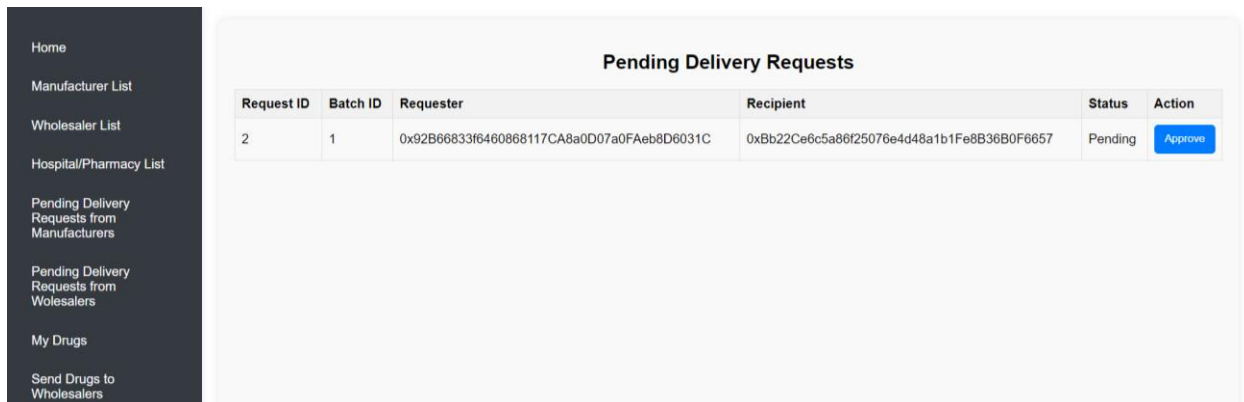
Distributor List					
Username	Account	Name	Address	Email	Mobile Number
neraj_333	0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657	Neraj Chopra	789 Nehru Nagar, Mumbai, Maharashtra, 400013	neraj@gmail.com	9987654321



After choosing a suitable distributor the wholesaler should navigate to the Send Drugs button and send a delivery request to the distributor. This transaction also goes through metamask and an alert is generated after the manufacturer confirms the transaction though metamask.



Now lets go to the distributors home page (code written in **Home3.jsx** inside components folder) to see whether he/she got the delivery request or not.



So the distributor got the delivery request which he/she need to approve so that the drug comes to him as an intermediary stakeholder.

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Wholesaler List

Hospital/Pharmacy List

Pending Delivery Requests from Manufacturers

Pending Delivery Requests from Wolessalers

My Drugs

Send Drugs to Wholesalers

Send Drugs to Hospitals/Pharmacies

Logout

My Drugs

Batch ID	Owner	Quantity	Final Recipient	Status
1	0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657	3	0x71192EB2A01e8EfE730050B250169e853Ee89cE1	In Transit2

So the drugs with Batch ID 1 which we are considering in our demonstration is now having the owner as the distributor at Transit 2 state because the ownership of the drug is now passed from the wholesaler to the distributor. The distributor also gets to know about the final recipient of the drug from the table. He checks whether the final recipient is a wholesaler or hospitals/pharmacies from the Wholesaler and Hospital/Pharmacy List.

Home

Manufacturer List

Wholesaler List

Hospital/Pharmacy List

Pending Delivery Requests from Manufacturers

Pending Delivery Requests from Wolessalers

Wholesaler List

Username	Account	Name	Address	Email	Mobile Number
akash_915	0x92B66833f6460868117CA8a0D07a0FAeb8D6031C	Akash Sharma	456 Park Street, Kolkata, West Bengal, 700016	akash@gmail.com	9123456789

Home

Manufacturer List

Wholesaler List

Hospital/Pharmacy List

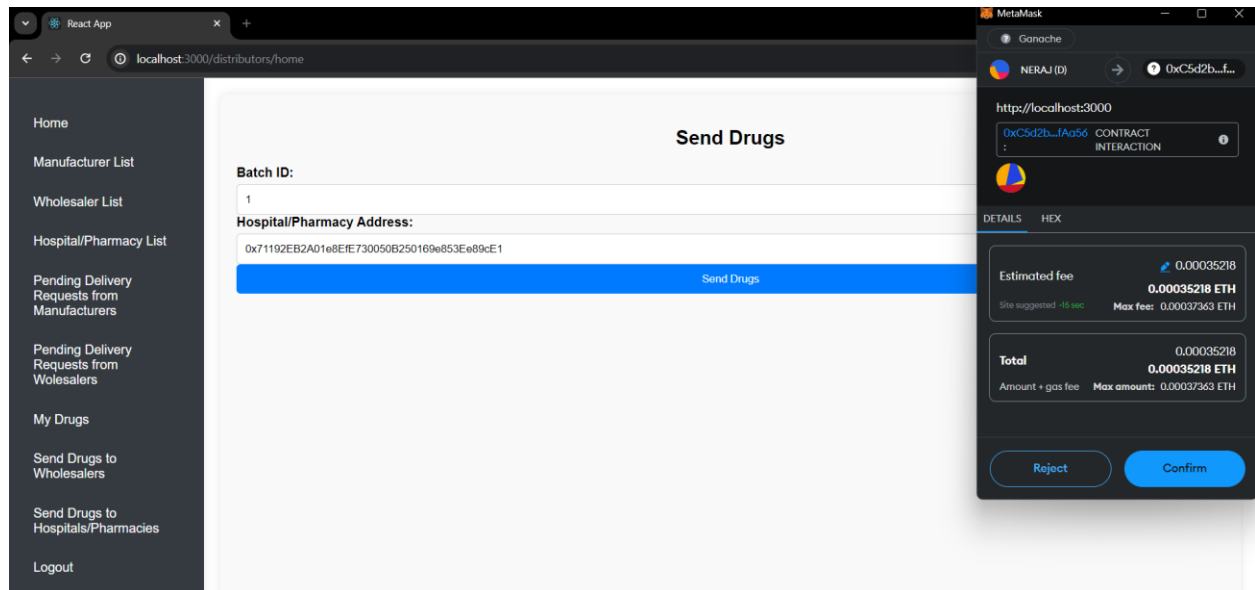
Pending Delivery Requests from Manufacturers

Pending Delivery Requests from Wolessalers

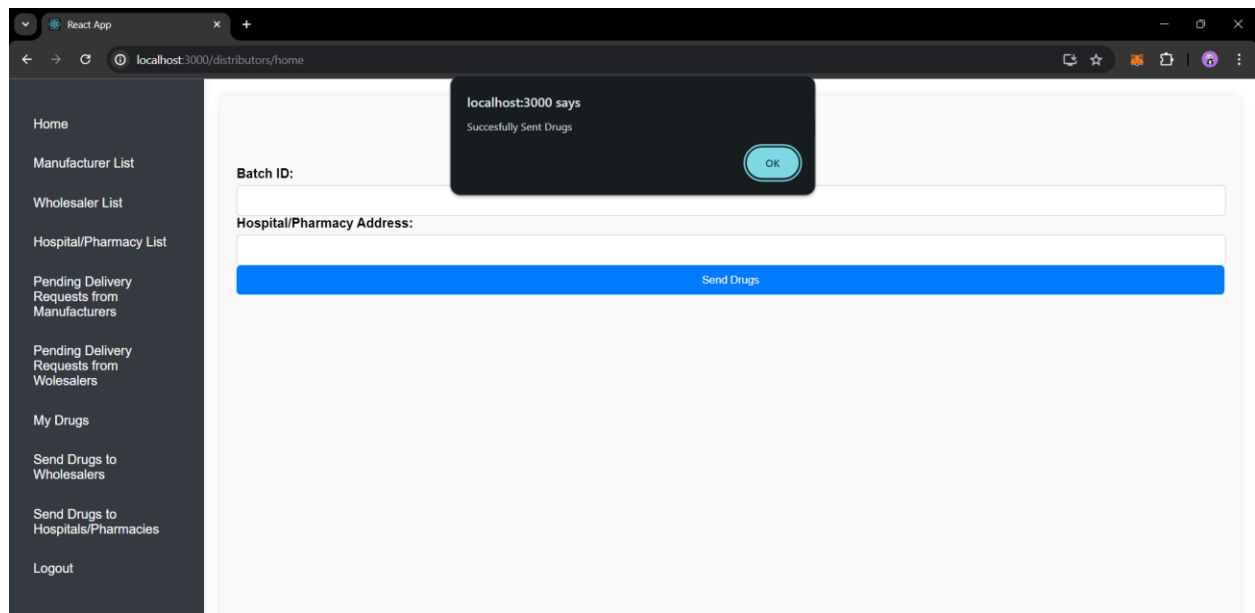
Hospital/Pharmacy List

Username	Account	Name	Address	Email	Mobile Number
prema_275	0x71192EB2A01e8EfE730050B250169e853Ee89cE1	Prerna Mehta	101 Jubilee Hills, Hyderabad, Telangana, 500033	prerna@gmail.com	9876512345

So now he proceeds for sending the drug to the appropriate recipient.



After clicking the confirm button on metamask the distributor finally sends a delivery request to the hospital.



Now let us check whether the wholesaler got the delivery request or not from the distributor.

Home

Wholesaler List

Request Drugs

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Logout

Pending Distributor Requests

Request ID	Batch ID	Requester	Status	Actions
0	1	0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657	Pending	<div>Approve</div>

So, the pending distributor requests are successfully fetched by the hospital and on approving this request via metamask the hospital will finally get the drug/batch of drugs from the wholesaler via a distributor.

Home

Wholesaler List

Request Drugs

Pending Delivery Requests

My Drugs

Logout

My Drugs

Batch ID	Owner	Quantity	Final Recipient	Status
1	0x71192EB2A01e8EfE730050B250169e853Ee89cE1	3	0x71192EB2A01e8EfE730050B250169e853Ee89cE1	Hospital/Pharmacy

So, the hospital finally got the batch of drugs (BatchID=1 which we are dealing with) from the wholesaler via a distributor. We can see that the owner and the final recipient of the drugs are same. So, we can conclude that the drugs reached their final destination.

So that's all about the second phase of our supply chain where we successfully sent the drugs to hospitals from wholesalers based on their request via a distributor.

So that's all about the whole pharmaceutical supply chain which we are dealing with. It leverages transparent and secure blockchain technology, along with QR codes and cryptographic key verifications, to ensure user satisfaction and verification at each step of the process. Now, let's take a closer look at how we use QR codes to track drugs and verify temperature and humidity data using IoT through our Drugs smart contract.

6) QR CODE TRACKING

In our pharmaceutical supply chain prototype we used qr code verification for each drugs so that we can track each and every drugs inside the supply chain. We used the **Track.jsx** file inside components folder to bring out the functionality of the qr code tracking.

To track a drug with its qr code one should go to the Track Drugs route which is present on the landing page. On clicking the Track Drugs button the person will be redirected to a page asking for a qr code and when the person will give the qr code and hit the track button the list of all transactions of the drug with that qr code will be rendered on the screen. This will help stakeholders verify the status of the drug at each step of the supply chain.

Track Drug

Track

Logout

Transaction History

QR Code: b

From: 0x00

To: 0x4De25487F504a7c7B1a2B2E6Ec98BcCB97BB61A8

Status: Manufactured

Timestamp: 1/21/1970, 3:45:30 AM

QR Code: b

From: 0x4De25487F504a7c7B1a2B2E6Ec98BcCB97BB61A8

To: 0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657

Status: In Transit1

Timestamp: 1/21/1970, 3:45:31 AM

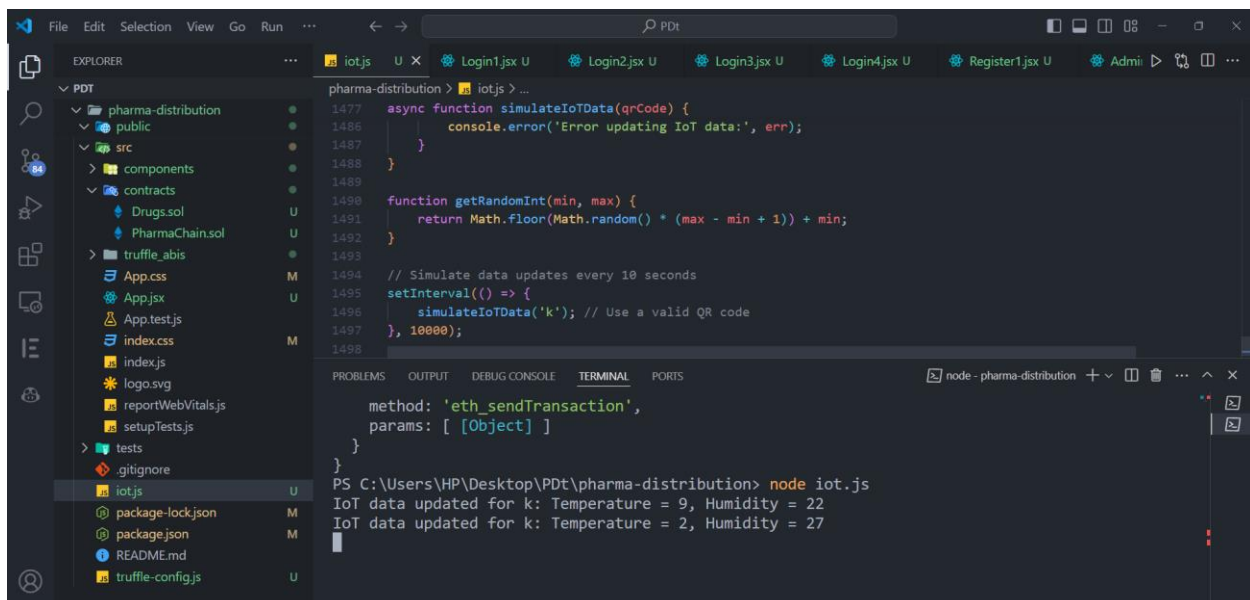
QR Code: b

From: 0xBb22Ce6c5a86f25076e4d48a1b1Fe8B36B0F6657

6) TEMPERATURE/HUMIDITY TRACKING

In our pharmaceutical supply chain prototype we used IOT script verification for each drugs so that we can track each and every drugs inside the supply chain and can create a alert message if the drug goes out of its recommended temperature and humidity. We used the **lot.jsx** file inside components folder to bring out the functionality of the temperature/humidity tracking.

To track a drug with its qr code one should go to the Track Temperature/Humidity route which is present on the landing page. On clicking the Track Temperature/Humidity button the person will be redirected to a page asking for a qr code and when the person will give the qr code and hit the Fetch lot Data button the latest temperature/humidity data along with list of all alerts will be rendered on the screen. This will help stakeholders verify the status of the drug at each step of the supply chain.



```
File Edit Selection View Go Run ...
pharma-distribution > iot.js > ...
1477 async function simulateIoTData(qrCode) {
1486   console.error('Error updating IoT data:', err);
1487 }
1488 }
1489
1490 function getRandomInt(min, max) {
1491   return Math.floor(Math.random() * (max - min + 1)) + min;
1492 }
1493
1494 // Simulate data updates every 10 seconds
1495 setInterval(() => {
1496   simulateIoTData('k'); // Use a valid QR code
1497 }, 10000);
1498
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
node - pharma-distribution
method: 'eth_sendTransaction',
params: [ [Object] ]
}
}
PS C:\Users\HP\Desktop\PDt\pharma-distribution> node iot.js
IoT data updated for k: Temperature = 9, Humidity = 22
IoT data updated for k: Temperature = 2, Humidity = 27
```

We used the **iot.js** script to auto-generate random temperature and humidity data for demonstration purposes. This script creates an interface to monitor these conditions, simulating how real-world applications could operate. In a practical scenario, this script would be replaced by actual IoT sensors, hardware, and oracle technologies to seamlessly integrate off-chain data with the blockchain.

Check IoT Data

QR Code:
k

Fetch IoT Data

Logout

Latest IoT Data for QR Code: k

Timestamp: 7/23/2024, 4:30:13 PM

Temperature: 1°C

Humidity: 57%

Alerts

QR Code: k
Message: Humidity out of range!
Timestamp: 7/23/2024, 4:30:13 PM

QR Code: k
Message: Temperature out of range!
Timestamp: 7/23/2024, 4:30:13 PM

So that's all about our decentralized pharmaceutical supply chain.

In conclusion, we want to mention that our pharmaceutical supply chain management project combines blockchain technology, IoT integration, and QR code verification to ensure a secure and transparent supply chain. By leveraging these advanced technologies, we provide enhanced tracking, verification, and user satisfaction throughout the entire supply chain process. Our innovative approach not only improves efficiency but also ensures the integrity and authenticity of pharmaceutical products.

Thank you for your attention and support.

Team Name: DragonFly

Team Members:

1. Bibhab Dasgupta
2. Riddhi Mandal

THANK YOU!