Blockchain for Industrial Engineers: Decentralized Application Development

บล็อกเชนสำหรับวิศวกรอุตสาหการ: การพัฒนาแอปพลิเคชันแบบกระจายศูนย์

Decentralized application (DApp)

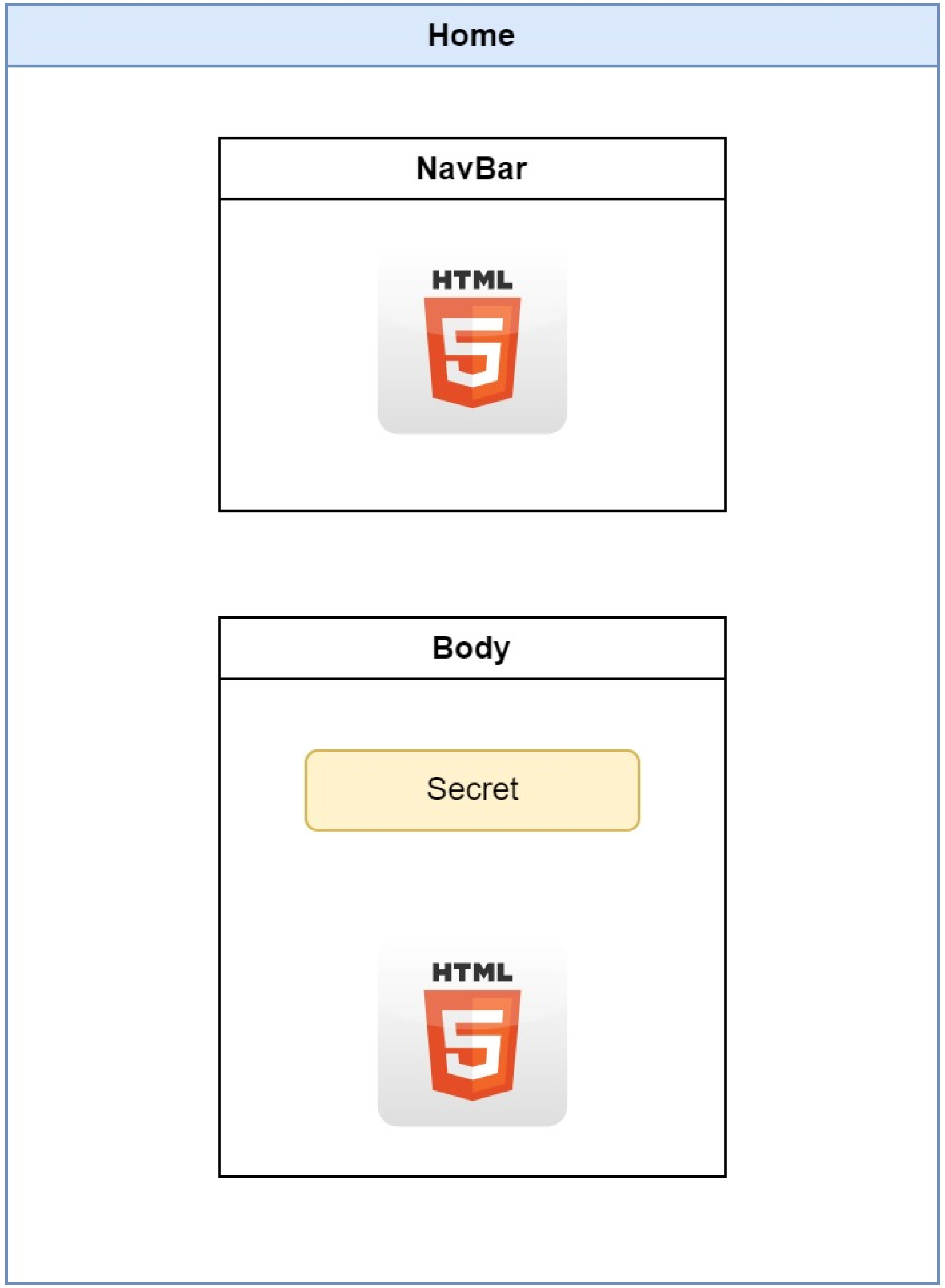
Part 1: Application structure

Template

- Fork the following repository
    - https://github.com/nnnpooh/blockchain-class-dapp
- Clone your new forked repository to local machine
    - `git clone ......`
- Open the newly cloned folder in `VSCode`
- Install library
    - `npm install`
- Run
    - `npm run dev`

Structure

- `Home` component
  - `NavBar` component
  - `Body` component
- Reactive variable
  - `secret`



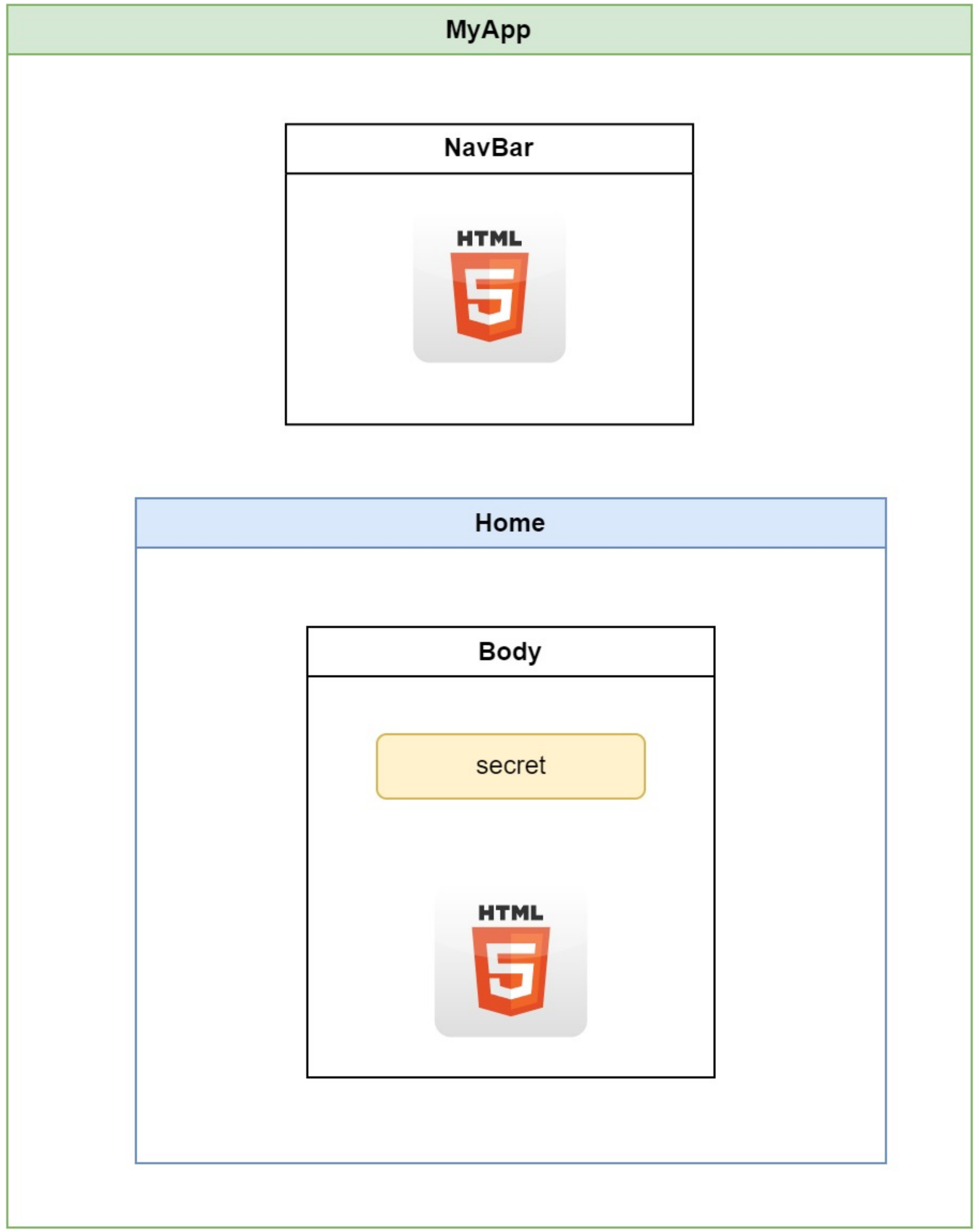
Part 2: Connecting to MetaMask

Library

- Install `ethers` library
  - `npm install ethers@5.7.2`

_app file

- Manage layout



Centralized store

Stores

- `useWorkingStore()`
  - `secret`
- `useMetaMaskStore()`
  - `account`
  - `balance`
  - `chainId`
  - `isEthereumAvailable`
  - `provider`
- `./src/utils/stores.ts`

Startup Logics

- Open MetaMask
- Setup listener
  - Change account
  - Change network
- `./src/utils/useEthereum.ts`
  - Using `useEffect` function
- Insert `useEthereum()` into `_app.tsx`

Fix `TypeScript` Error

- `types/index.d.ts`

```
import { ExternalProvider } from "@ethersproject/providers";
import { MetaMaskInpageProvider } from "@metamask/providers";

declare global {
  interface Window {
    ethereum?: MetaMaskInpageProvider;
  }
}

export {};
```

- `tsconfig.json`

```
...
"typeRoots": ["./node_modules/@types", "./src/types"],
...
```

React to change in state

- When you change account and network in Metamask, the application should react to it.
    - `useEffect` with dependency.
- ./src/utils/useMetaMask.ts
- Insert `useEthereum()` into `_app.tsx`
- Insert `useMetaMask()` into into `_app.tsx`

Update `AccountButton`

- AccountButton

Part 3: Incorporating smart contract

HardHat

- Create a contact `Secret.sol` (code below)
- Compile the contract
  - `npx hardhat compile`
  - Obtain `Secret.json`
- Create a deploy script `deploy-secret.ts` (code below)
- Deploy the contract.
  - `npx hardhat run --network goerli ./scripts/deploy-secret.ts`
  - *(You need Alchemy key.)*
- Obtain contract address

./contracts/Secret.sol

```
// SPDX-License-Identifier: GPL-3.0
pragma solidity >=0.7.0 <0.9.0;
contract Secret {
    string public secret;
    address public owner;
    constructor(string memory _secret) {
        owner = msg.sender;
        secret = _secret;
    }
    modifier onlyOwner() {
        require(msg.sender == owner, "Only owner can change the message.");
        _;
    }
    function changeSecret(string memory _secret) public onlyOwner {
        secret = _secret;
    }
}
```

```
./scripts/deploy-secret.ts
```

```typescript
import { ethers } from "hardhat";

async function main() {
  const Secret = await ethers.getContractFactory("Secret");
  const secret = await Secret.deploy("Really Secret Message");
}
main().catch((error) => {
  console.error(error);
  process.exitCode = 1;
});
```

Insert smart contract to DApp

- Copy `Secret.json` from HardHat to `./src/abi`
- Create `./src/abi/secret.ts`

```
import Secret from "./Secret.json";
export const SecretContract = Secret;
export const contractAddress = process.env.NEXT_PUBLIC_CONTRACT_ADDRESS || "";
```

- Create `./.env` ("Dot" ENV file)
    - Insert your contract address (from Etherscan)

```
NEXT_PUBLIC_CONTRACT_ADDRESS=........
```

Create logics to fetch and change `secret`

- Create `./src/components/home/useContract.ts`
    - Fetch `secret` message when there is a change in accout and network.
        - When `secret` cannot be fetched, handle the error.
    - Export `writeSecret` function to change `secret` when the button is pressed.
    - Keep track of the loading state through `isLoading`.
    - Keep track of error state through `isError`.
    - Code

Update UI

- Modify `./src/components/home/Body.tsx`
    - Display real `secret`
    - Button will trigger transaction from MetaMask.
    - Show loading state (loading spinner).
    - Show errors (icon) when `secret` cannot be fetched.
    - Disable input when errors occur.
    - Code
- Personalize your application.

Building project

- Ignore code checking rules.
  - Change `ignoreDuringBuilds` to `true`

`./next.config.mjs`

```
  eslint: {
    ignoreDuringBuilds: true, // Change from false to true
  },
```

- `npm run build`

Upload your change to GitHub

- `git add .`
- `git commit -m "Working Version"`
- `git push`

Deploy your DApp to cloud provider

- https://vercel.com/
- Sign up with your GitHub account
- In the `Let's build something new.` page
  - Under `Import Git Repository`
    - Select `+ GitHub Account`
  - Your should see your repository name appearing.
  - Click `Import`

Deploy your DApp to cloud provider

- In the `You're almost done.` page
    - Under `Environment Variables`
        - `Name`: `NEXT_PUBLIC_CONTRACT_ADDRESS`
        - `Value`: *[Contract Address]*
    - Save the change.
    - Click `Deploy`
- Once finished, you should see the link to your DApp in the dashboard page.
    - You can also change the domain by going to `Settings` -> `Domains`

Testing your app

- Make sure you have the environment variable in `Settings` -> `Environment Variables`
- If you make changes to the environment variables
  - Go to the `Deployments` tab
  - Click at dropdown menu of the last deployment.
  - Click `Redeploy`

Yay ....