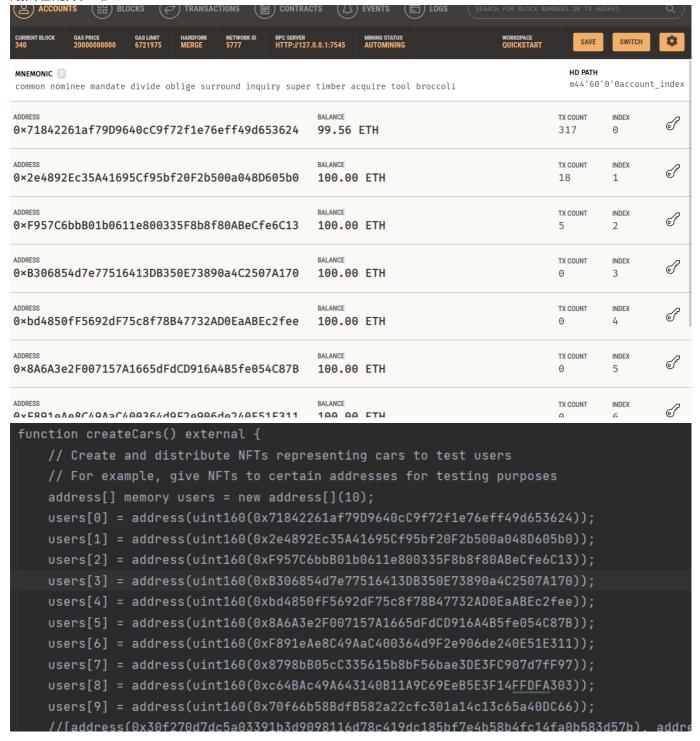
1.如何运行

1.在本地启动ganache应用 2.在 ./contracts 中安装依赖, 运行如下命令:

```
npm install
```

3.在ganache中复制自己的账户地址,在./contracts/contracts/BorrowYourCar.sol中的createCars函数中和,粘贴自己的账户地址



4.在ganache中复制账户密钥,粘贴到.\contracts\hardhat.config.ts中:

```
// the private key of signers, change it according to your ganache user
accounts: [
    '0xbe941220748bdaa97dfd4f3838f326b04a110cda2d08d07646aded6bd787f15e',
    '0xff3a08282582b0c760476ddef837f3aa53a7a5010b4cd8f4e996e81644df17d1',
    '0xffc1a02b9952db5d0e1d7717b948f4cfc6948e24b7864e2facfa32ae35659f83',
    '0xd109dd3d194d9d2dde8a780663d941f66f217c140dcdf53fdb632854faa62d45',
    '0xc661ea86d0323c970c7d6dc459afacbff62fb6b0fe3dd89f70268972f45ae851',
    '0x4ea5fd8c2f092518ec5fc1f4155714a5d1c6a55a1c39d8afb3a2bd2f3fcd5c5d',
    '0x95275c9a371eb87eb7daf1b03701611292c7d5a07f764628a2f7ddab0425110f',
    '0x7fe17b2728daf646504a6ba87940f347592d618c5977a137a1c7178ac9ec2d90',
    '0xdf98e826582f001f24d9a1f9f6a33394ecbe8ce3defd3296c05342f1d6593e6a0',
    '0x34365603b96420772b6505ccbd5e47fb19fa8c19c8a2e74e6db2aa57c6ad93b0'
```

5.在./contracts 中编译合约,运行如下命令:

```
npx hardhat run ./scripts/deploy.ts --network ganache
```

6.复制打印出来的合约地址到 ./fronted/src/utils/contract-addresses.json 中

7.在 ./fronted 中安装依赖,运行如下命令:

```
npm install
```

8.在 ./ fronted 中启动前端程序, 运行如下命令:

```
npm run dev
```

2.功能实现分析

2.1查看自己拥有的汽车列表

在合约中实现了getOwnedCar函数:

```
function getOwnedCars(address owner) external view returns (uint256[] memory) {
    // Get the list of car token IDs owned by a specific user
    uint256 counter = 0;
    for (uint256 i = 0; i < totalCars; i++) {</pre>
```

在前端中通过按钮触发并且调用它, 渲染数据到listOfResult中:



```
async showOwnedVehicles() {

// 处理显示自己已拥有车辆的逻辑
const tempList = Object.assign([], await BorrowYourCarContract.methods.getOwnedCars(this.currentUser).call())

// console.log(tempList3)

this.listOfMyOwnedCars = this.getCarDetailsArray(tempList)

// console.log(this.listOfMyOwnedCars)

this.listData = Object.assign([], this.listOfMyOwnedCars)

// console.log(this.listData)

Promise.all(this.listData)

.then((result) => {

// 将结果存储在一个同步数组中

this.listOfResult = result

console.log(this.listofResult) // 输出同步数组

})

.catch((error) => {

console.error(error) // 处理错误情况

})

},
```

2.2查看自己已经借用的车辆

在合约中实现了getMyBorrowedCars函数:

```
function getMyBorrowedCars(address borrower1) external view returns (uint256[]
memory) {
    uint256 count = 0;
```

```
for (uint256 i = 0; i < totalCars; i++) {
    if (cars[i].borrower == borrower1&&cars[i].isBorrowed) {
        count++;
    }}
    uint256[] memory MyBorrowedCars = new uint256[](count);
    count = 0;
    for (uint256 i = 0; i < totalCars; i++) {
        if (cars[i].borrower == borrower1 && cars[i].isBorrowed) {
            MyBorrowedCars[count] = i;
            count++;
    }
}
return MyBorrowedCars;</pre>
```

在前端中通过按钮触发并且调用它, 渲染数据到listOfResult中:



```
async showBorrowedCars() {
    // console.log('1')
    const tempList3 = Object.assign([], await BorrowYourCarContract.methods.getMyBorrowedCars(this.currentUser).call())
    // console.log(tempList3)
    this.listOfMyBorrowedCars = this.getCarDetailsArray(tempList3)
    // console.log(this.listOfMyOwnedCars)
    this.listData = Object.assign([], this.listOfMyBorrowedCars)
    // console.log(this.listData)
    Promise.all(this.listData)
    rhen((result) => {
        // 将结果存储在一个同步数组中
        this.listOfResult = result
        console.log(this.listOfResult) // 输出同步数组
    })
    .catch((error) => {
        console.error(error) // 处理错误情况
    })
},
```

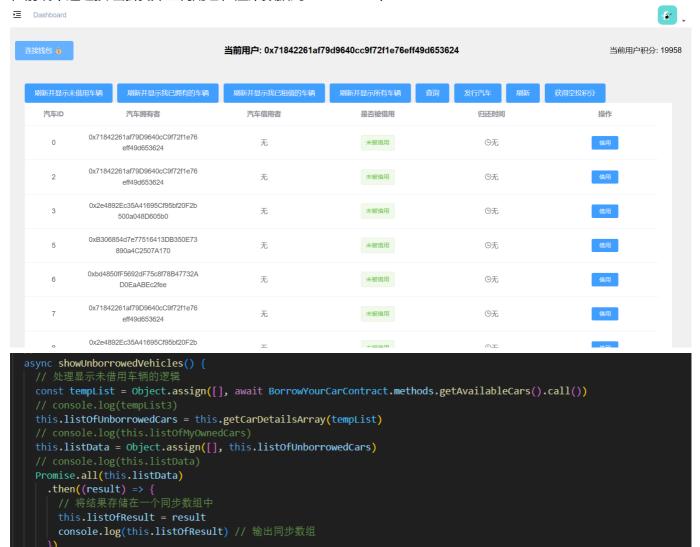
2.3查看当前还没有被借用的汽车列表

在合约中实现了getAvailableCars函数:

```
function getAvailableCars() external view returns (uint256[] memory) {
    // Get the list of available car token IDs (not currently borrowed)
    uint256[] memory availableCars = new uint256[](totalCars -
```

```
totalRentedCars);
    uint256 counter = 0;
    for (uint256 i = 0; i < totalCars; i++) {
        if (ownerOf(i) != address(0) && !cars[i].isBorrowed) {
            availableCars[counter] = i;
            counter++;
        }
    }
    return availableCars;
}</pre>
```

在前端中通过按钮触发并且调用它, 渲染数据到listOfResult中:

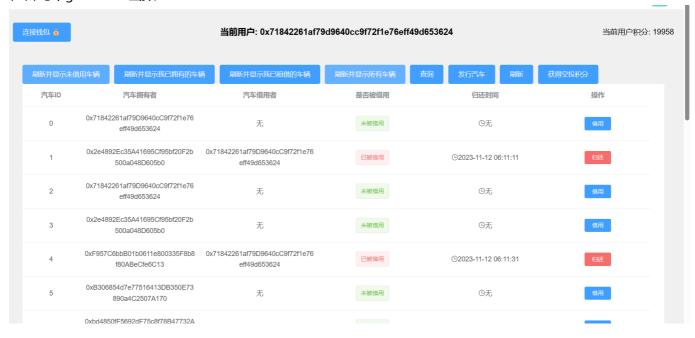


2.4显示所有的汽车列表

console.error(error) // 处理错误情况

.catch((error) => {

在合约中getAllCars函数:



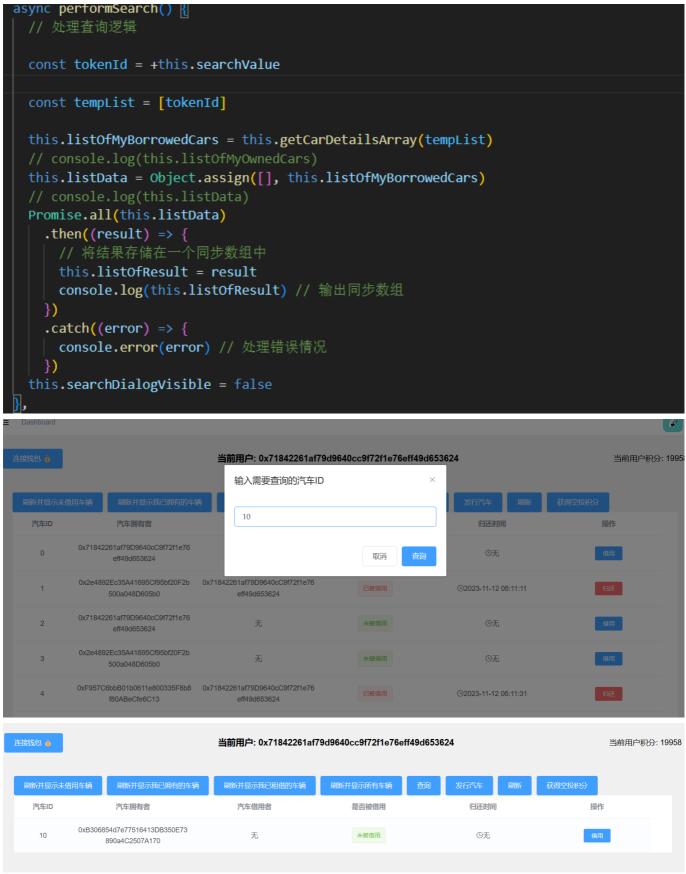
```
function getAllCars() external view returns (uint256[] memory) {
    uint256[] memory allCars = new uint256[](totalCars);
    for (uint256 i = 0; i < totalCars; i++) {
        allCars[i] = i;
    }
    return allCars;
}</pre>
```

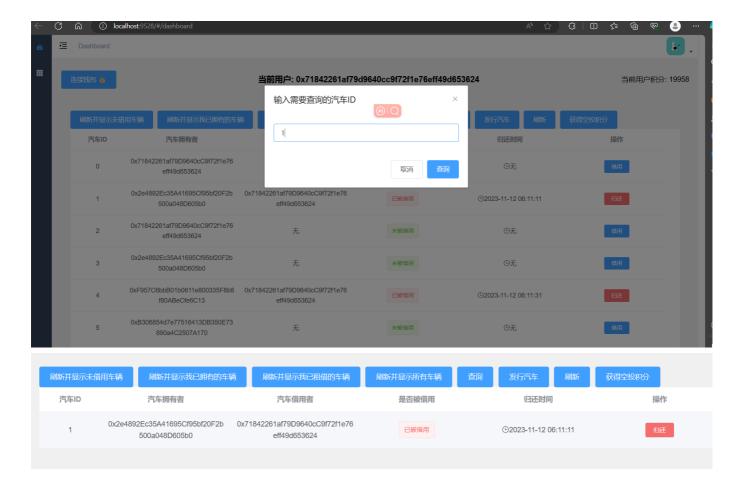
在前端中通过按钮触发并且调用它, 渲染数据到listOfResult中:

```
async showAllCars() {
    const tempList = Object.assign([], await BorrowYourCarContract.methods.getAllCars().call())
    // console.log(tempList3)
    this.listOfAllCars = this.getCarDetailsArray(tempList)
    // console.log(this.listOfMyOwnedCars)
    this.listData = Object.assign([], this.listOfAllCars)
    // console.log(this.listData)
    Promise.all(this.listData)
    .then((result) => {
        // 将结果存储在一个同步数组中
        this.listOfResult = result
        console.log(this.listOfResult) // 输出同步数组
    })
    .catch((error) => {
        console.error(error) // 处理错误情况
    })
},
```

2.5查询一辆汽车的主人,以及该汽车当前的借用者

通过输入需要查询的汽车的ID号,在汽车列表中查找并且返回它,最后渲染到listOfResult中:





2.6选择并借用某辆还没有被租借的汽车一段时间,使用自己发行的ERC20 积分支付

在合约中实现了borrowCar函数:

```
function borrowCar(uint256 carTokenId, uint256 duration) external {
        require(ownerOf(carTokenId) != address(0), "Car does not exist");
        require(cars[carTokenId].borrower == address(0), "Car is already
borrowed");
        address borrower = msg.sender;
        uint256 startTime = block.timestamp;
        uint256 borrowUntil = startTime + duration;
        calculateBorrowCost(duration);
        // Update the car's information
        cars[carTokenId].borrower = borrower;
        cars[carTokenId].borrowUntil = borrowUntil;
        cars[carTokenId].isBorrowed = true;
        totalRentedCars++;
        myERC20.transferFrom(msg.sender,address(this) , tokenAmount);
        myERC20.transfer(cars[carTokenId].owner,
myERC20.balanceOf(address(this)));
        // emit CarBorrowed(carTokenId, borrower, startTime, duration);
    }
```

在前端中通过按钮触发并调用它:



当前用户积分: 19958



当前用户积分: 19923

```
async confirmBorrow(id, duration) {

// 在这里处理借用时间的逻辑,例如发送请求或更新数据等

// console.log(this.selectedRow.borrowUntil)

// 关闭对话框

const costAmount = parseInt(+duration / 3600 + 1)

await myERC20Contract.methods.approve(BorrowYourCarContract.options.address, costAmount).send({

from: this.currentUser

})

console.log('3')

await BorrowYourCarContract.methods.borrowCar(id, duration).send({ from: this.currentUser })

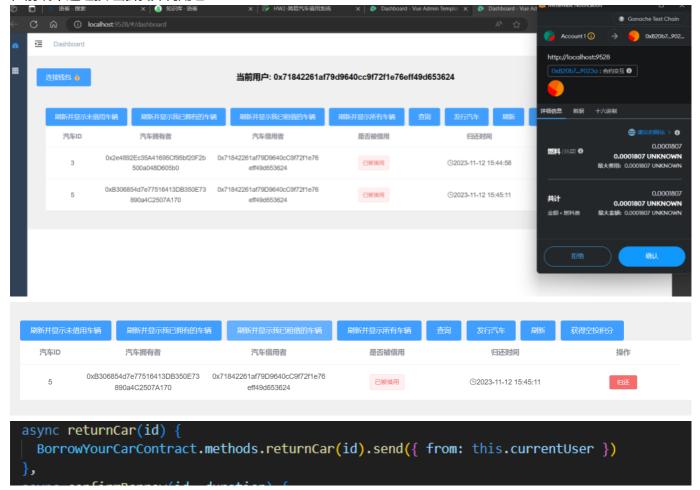
this.userScore = await myERC20Contract.methods.balanceOf(this.currentUser).call()

this.dialogVisible = false
```

2.7归还汽车

在合约中实现了returunCar函数:

在前端中通过按钮触发并调用它:



2.8发行汽车

在合约中实现createCars函数:

```
function createCars() external {
        // Create and distribute NFTs representing cars to test users
        // For example, give NFTs to certain addresses for testing purposes
        address[] memory users = new address[](10);
        users[0] = address(uint160(0x71842261af79D9640cC9f72f1e76eff49d653624));
        users[1] = address(uint160(0x2e4892Ec35A41695Cf95bf20F2b500a048D605b0));
        users[2] = address(uint160(0xF957C6bbB01b0611e800335F8b8f80ABeCfe6C13));
        users[3] = address(uint160(0xB306854d7e77516413DB350E73890a4C2507A170));
        users[4] = address(uint160(0xbd4850fF5692dF75c8f78B47732AD0EaABEc2fee));
        users[5] = address(uint160(0x8A6A3e2F007157A1665dFdCD916A4B5fe054C87B));
        users[6] = address(uint160(0xF891eAe8C49AaC400364d9F2e906de240E51E311));
        users[7] = address(uint160(0x8798bB05cC335615b8bF56bae3DE3FC907d7fF97));
        users[8] = address(uint160(0xc64BAc49A643140B11A9C69EeB5E3F14FFDFA303));
        users[9] = address(uint160(0x70f66b58BdfB582a22cfc301a14c13c65a40DC66));
//[address(0x30f270d7dc5a03391b3d9098116d78c419dc185bf7e4b58b4fc14fa0b583d57b),
address(0xf13d4b0ab910c8d78bb22629c858ea73ee22d9b0a5e8bd462d48190c49bd14b3)];
        for (uint256 i = 0; i < 2; i++) {
            // Mint a car NFT and assign it to the user
            uint256 tokenId = mintCar(users[i]);
            // Update the car's owner in the cars mapping
```

```
cars[tokenId].owner = users[i];
    for (uint256 i = 0; i < 5; i++) {
                // Mint a car NFT and assign it to the user
                uint256 tokenId = mintCar(users[i]);
                // Update the car's owner in the cars mapping
                cars[tokenId].owner = users[i];
    for (uint256 i = 0; i < 7; i++) {
                // Mint a car NFT and assign it to the user
                uint256 tokenId = mintCar(users[i]);
                // Update the car's owner in the cars mapping
                cars[tokenId].owner = users[i];
     for (uint256 i = 0; i < 10; i++) {
                         // Mint a car NFT and assign it to the user
                         uint256 tokenId = mintCar(users[i]);
                         // Update the car's owner in the cars mapping
                         cars[tokenId].owner = users[i];
                     }
}
```

查询 发行汽车 刷新

在前端中通过按钮触发并调用它:

```
async createCars() {
  await BorrowYourCarContract.methods.createCars().send({ from: this.currentUser })
},
```

3.项目运行截图

按照以下流程操作:编译部署合约,启动前端,连接钱包,发行汽车,显示所有汽车,显示自己拥有的汽车,获得空投积分,借用一些汽车,显示已借用的汽车,显示未借用的汽车,归还汽车,显示已经借用的汽车,查询一辆汽车下面是按照此流程运行的截图:编译部署合约:

```
PS C:\Users\17875\Desktop\courses\区块链\HW2\ZJU-blockchain-course-2023\contracts> npx hardhat run ./scripts/deploy.ts --network ganache
BorrowYourCar deployed to 0xB20b7b1425C789C768f785AA2087FA170C69023a
erc20 contract has been deployed successfully in 0xE609FB420A695725716f879E0aE00b204D50bDfB

"BorrowYourCar": "0xB20b7b1425C789C768f785AA2087FA170C69023a",

"myERC20": "0xE609FB420A695725716f879E0aE00b204D50bDfB"
```

启动前端:



连接钱包:

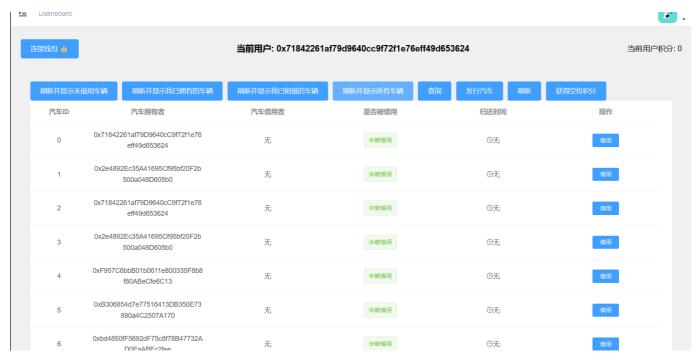




发行汽车:



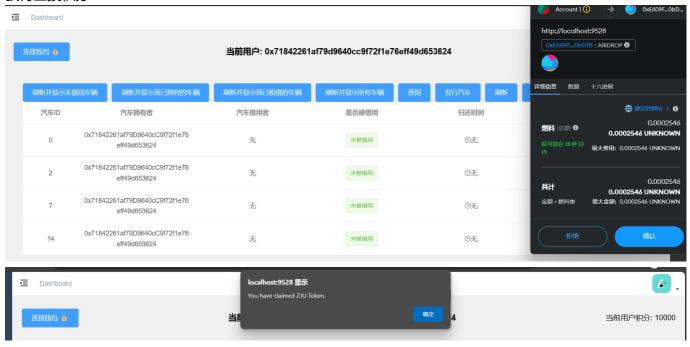
显示所有汽车:



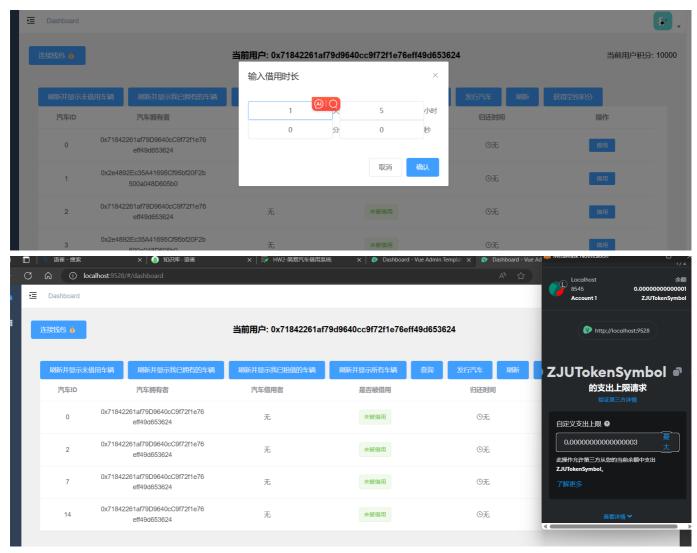
显示自己拥有的汽车:



获得空投积分:



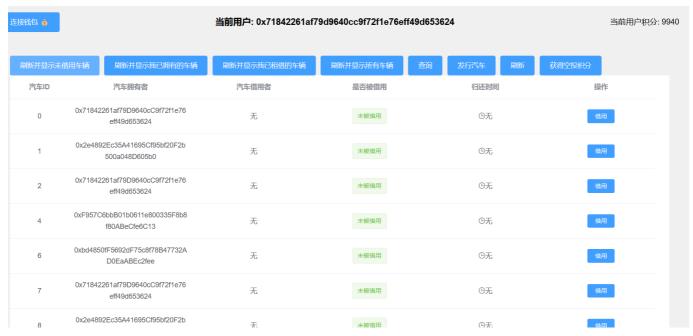
借用一些汽车(一共借了两辆,因为操作一样,只放了借用其中一辆时的截图):



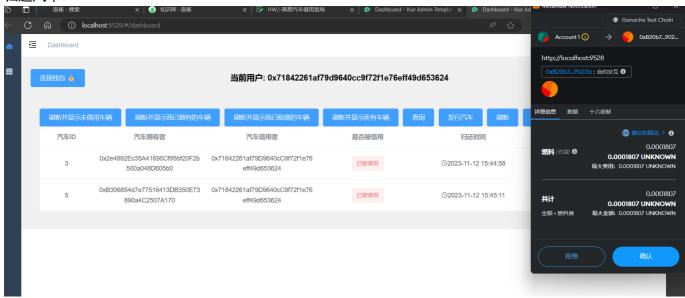
显示我已借用汽车列表:



显示所有未借用汽车



归还汽车:



显示我已借用汽车列表:



查询一辆汽车:

