RPlaceV2 DApp Report

Name: Nguyen Xuan Nam

SID: 21195511

Course: HKUST COMP4541

Source Code

- Repository, Front-end: GitHub - vnnamng/rplace-dapp
- Submodule, Contract: GitHub - vnnamng/rplace_contract

📌 Motivation

The **RPlaceV2 DApp** draws inspiration from two powerful ideas:

- **Reddit's r/place (2017, 2022):** A social experiment where users collaboratively drew on a shared canvas by placing one pixel at a time, limited by a cooldown. It highlighted coordination, community rivalry, and emergent behavior.

- **Land Property Auctions:** In the real world, land is scarce and owned. Property markets are driven by demand, competition, and valuation. RPlaceV2 maps this idea to a pixel canvas where each pixel is a unique digital asset, purchasable and owned on the blockchain.

Together, RPlaceV2 transforms a social game into a decentralized economic experiment on **Ethereum**, where canvas pixels are digital property owned and traded using ETH.

🔗 How It Works

1. Connect Wallet

- Users install **MetaMask** and add the **Sepolia testnet**.
- On clicking **Connect Wallet**, MetaMask connects the user's Ethereum address to the DApp.

Connected: 0xF87e...65C2

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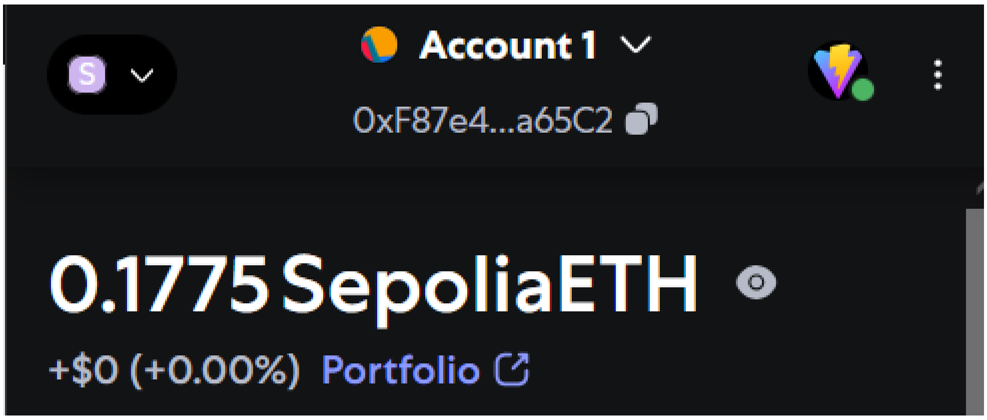
2. Acquire SepoliaETH

- Test currency is needed to interact with the DApp.

- Users get **SepoliaETH** from public faucets like:

  - Google Cloud Faucet
  - PK910 Faucet



Account 1

0xF87e4...a65C2

0.1775 SepoliaETH

+$0 (+0.00%) Portfolio

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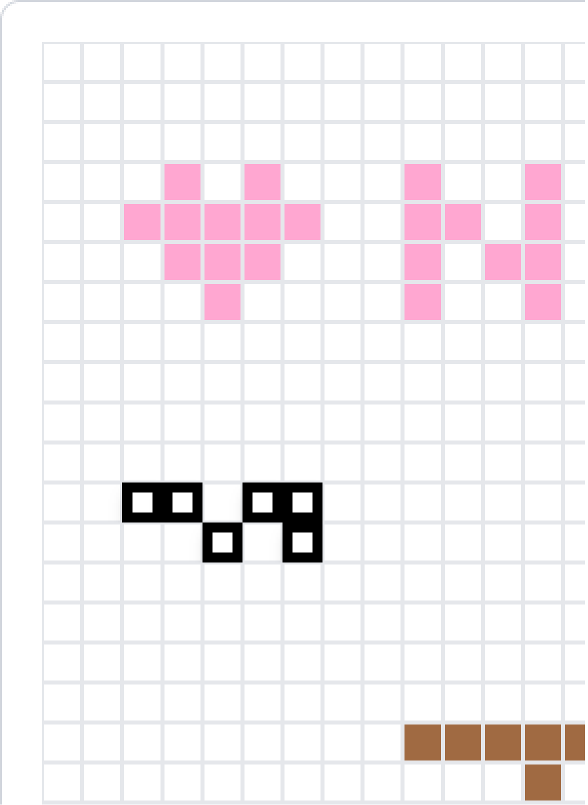
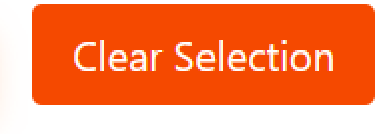
3. Select and Buy Pixels

🎨 Pixel Selection



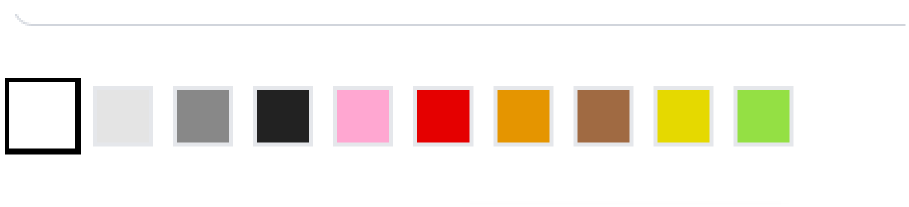
- Users can **click** to select multiple pixels.
- The selected pixels are highlighted with a **bolded border**.
- Users can **deselect** pixels by clicking them again.
- Click **Clear Selection** at the bottom to remove all selected pixels.



Clear Selection

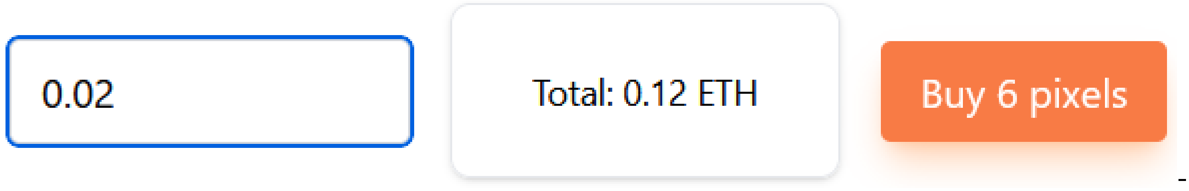
🎨 Color Palette

- There are **10 predefined color choices** available.
- The selected color is applied to all chosen pixels.



💰 Set ETH Price and Buy

- After selection, users enter a price in **ETH per pixel**.
- On clicking **Buy**, a transaction is submitted to the smart contract.
- Ownership and color of the pixels are updated **on-chain**.

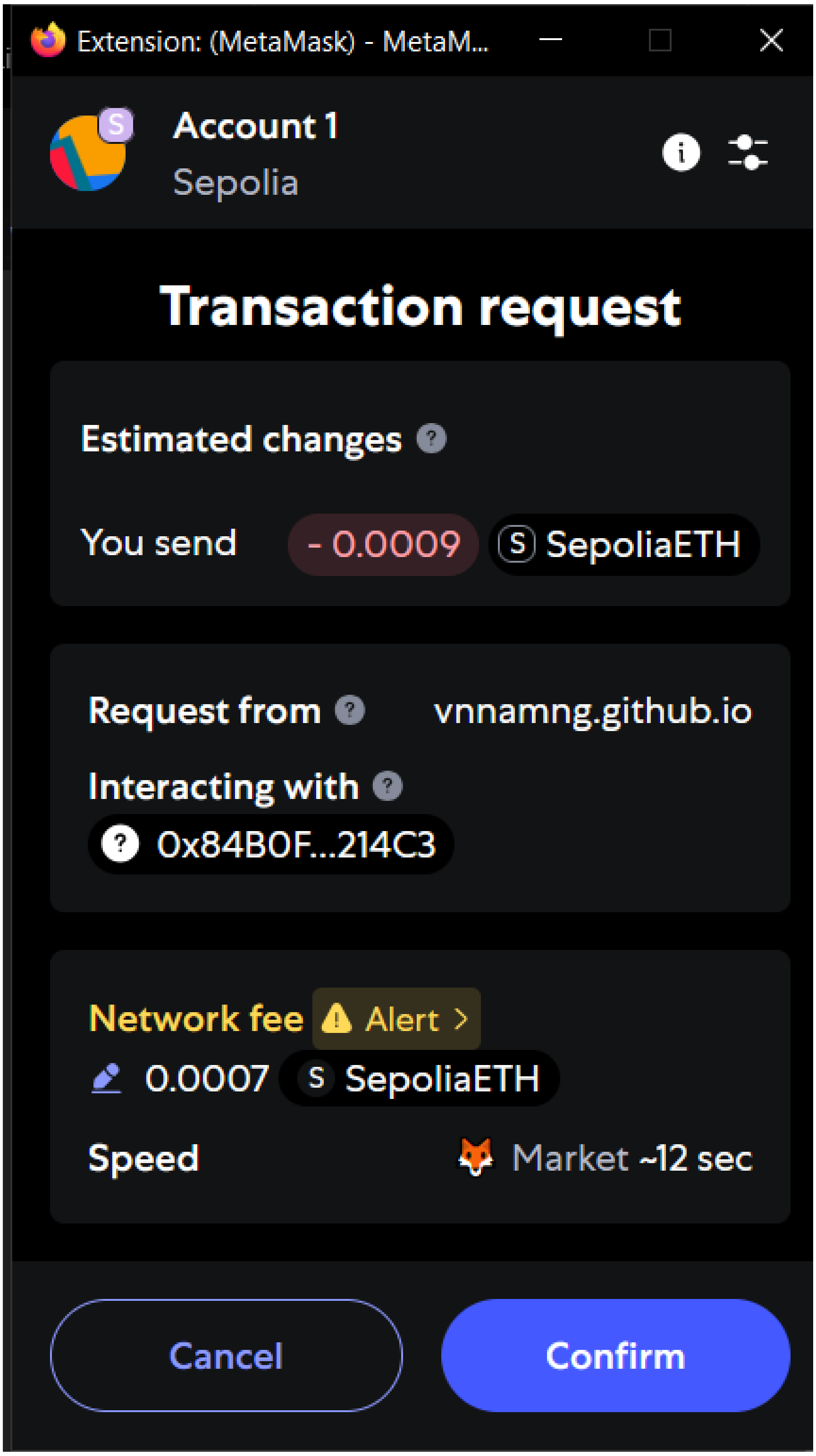


0.02

Total: 0.12 ETH

Confirming the Transaction

- Users confirm the transaction in MetaMask.



Extension: (MetaMask) - MetaM...

Account 1
Sepolia

Transaction request

Estimated changes

You send - 0.0009 SepoliaETH

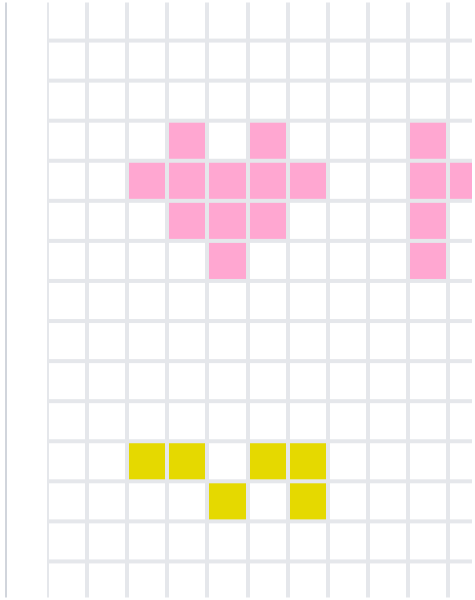
Request from vnnamng.github.io

Interacting with 0x84B0F...214C3

Network fee Alert
0.0007 SepoliaETH

Speed Market ~12 sec

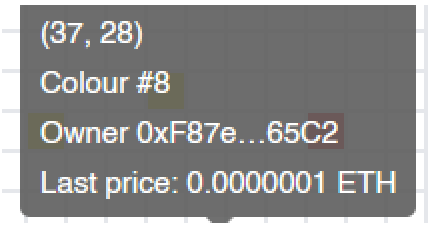
- The transaction is processed on the **Sepolia testnet**.
- The **canvas** updates in real-time to reflect the new pixel ownership and color.



🧠 Smart Contract Features

👁️ Live Ownership Tracking

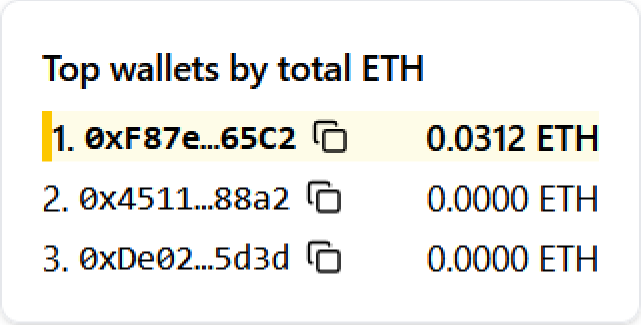
- Each pixel is tied to a specific **wallet address**.
- Users can hover or click pixels to see current owner information.



(37, 28)
Colour #8
Owner 0xF87e…65C2
Last price: 0.0000001 ETH

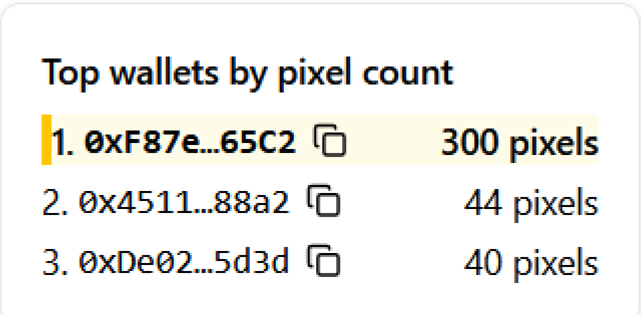
🏆 Leaderboards

- Two live leaderboards are maintained:
  - **Top ETH Spenders**: Total ETH spent on pixel purchases
  - **Top Landlords**: Number of pixels owned
- These rankings update in **real-time** via smart contract event listeners.
- Yellow highlights the current wallets in each leaderboard.



Top wallets by total ETH

1. 0xF87e…65C2	**0.0312 ETH**
2. 0x4511…88a2	0.0000 ETH
3. 0xDe02…5d3d	0.0000 ETH



Top wallets by pixel count

1. 0xF87e...65C2	300 pixels
2. 0x4511...88a2	44 pixels
3. 0xDe02...5d3d	40 pixels

🛠️ Development Details

- **Smart Contract**: `1_PixelWarV2.sol`, deployed to Sepolia
- **Frontend**: Built with **React + Vite**
- **Real-Time Updates**: Powered by Ethereum events and UI state syncing
- **Contract Address**: `0x84B0FD3dd1288542f4E189f8170eB94B303214C3`
- **ABI**: See `src/constants.js`

Errors and Issues

Why Transactions May Fail:

1. **Insufficient Balance** The wallet does not have enough SepoliaETH to cover the total pixel cost and gas fees.

2. **Pixel Already Owned by Someone Else** Between selection and purchase, another user might have bought one or more of the selected pixels.

3. **Gas Limit Too Low** Complex transactions involving many pixels may exceed the gas limit set in MetaMask.

4. **Network Issues / Timeout** MetaMask may reject or drop transactions due to RPC failures or user denial.

5. **Invalid Parameters** For example:

   - Price per pixel is zero or too high
   - Invalid color index
   - Empty pixel selection

6. **Smart Contract Errors**

   - Revert conditions in Solidity such as duplicate ownership or invalid array input sizes.

Troubleshooting Tips:

- Ensure at least **0.0001 SepoliaETH** is available before purchasing.
- Try buying fewer pixels at once if the gas cost is too high.
- Refresh the canvas to check for pixel ownership updates before submitting.
- Always verify parameters before confirming the transaction in MetaMask.