Summary of blockchain basics:

Blockchain is a distributed and decentralized ledger technology that securely records transactions across a global peer-to-peer network. Instead of relying on a central authority, blockchain ensures that every participant (or node) maintains a synchronized copy of the ledger. Each block stores transaction data, a timestamp, and a cryptographic hash linking it to the previous block, forming an immutable and tamper-resistant chain of records.

Core Concepts include:

- **Distributed Ledger Technology (DLT):**
  The blockchain operates without a single point of failure or control. Every node on the network validates and stores the same data, increasing transparency, resilience, and fault tolerance.

- Consensus Mechanisms:
  Consensus algorithms maintain the integrity of the blockchain by ensuring that all nodes agree on the current state of the ledger.

    - Proof of Work (PoW): Miners compete to solve complex cryptographic puzzles to validate transactions and secure the network, as seen in Bitcoin.

    - Proof of Stake (PoS): Validators are selected based on their staked tokens, reducing energy consumption and increasing efficiency. Ethereum now operates on PoS after its "Merge" upgrade.

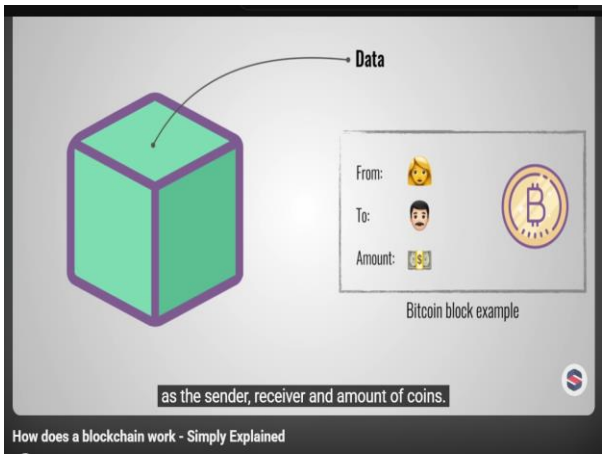
- Cryptography:
  Blockchain security relies on advanced cryptographic techniques. Public and private key pairs allow users to sign and verify transactions securely, ensuring authenticity and data integrity while maintaining pseudonymity.

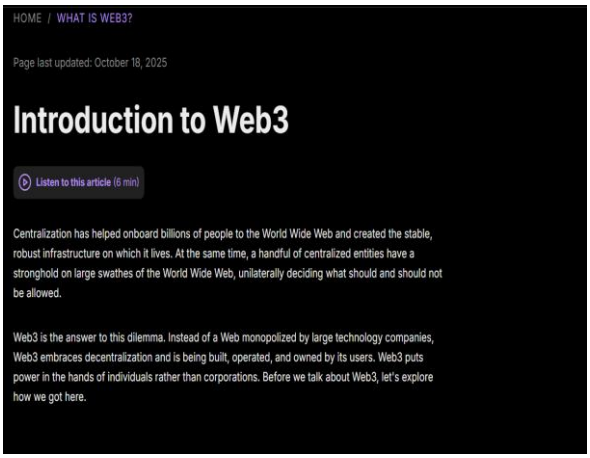
- Immutability&Transparency:
  Once recorded, blockchain data cannot be altered without network consensus. This provides an auditable and trustworthy record of all activities.

- SmartContracts:
  Beyond simple transactions, modern blockchains like Ethereum enable programmable logic through smart contracts — self-executing code that automatically enforces agreements when predefined conditions are met.

In essence, blockchain technology redefines digital trust by replacing intermediaries with cryptographic verification and consensus, paving the way for decentralized finance (DeFi), non-fungible tokens (NFTs), and next-generation Web3 applications.

Screenshots:

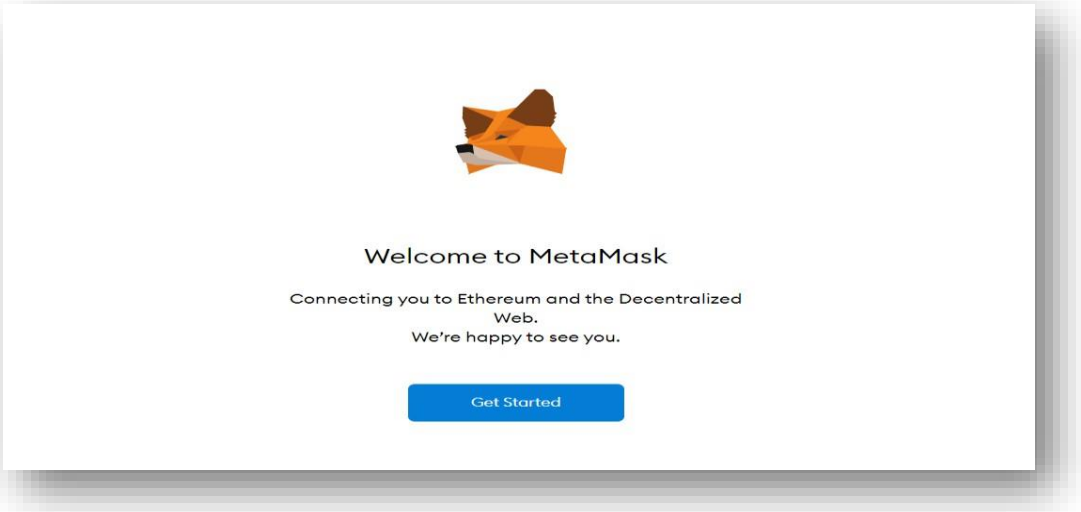




MetaMask Setup Process:

MetaMask was installed as a browser extension to serve as my crypto wallet and Web3 gateway. I created a new wallet and carefully wrote down the secret recovery phrase, keeping it stored securely offline. After setup, I enabled test networks in the settings and connected MetaMask to the Sepolia Test Network, allowing me to send, receive, and manage test ETH safely without using real funds.

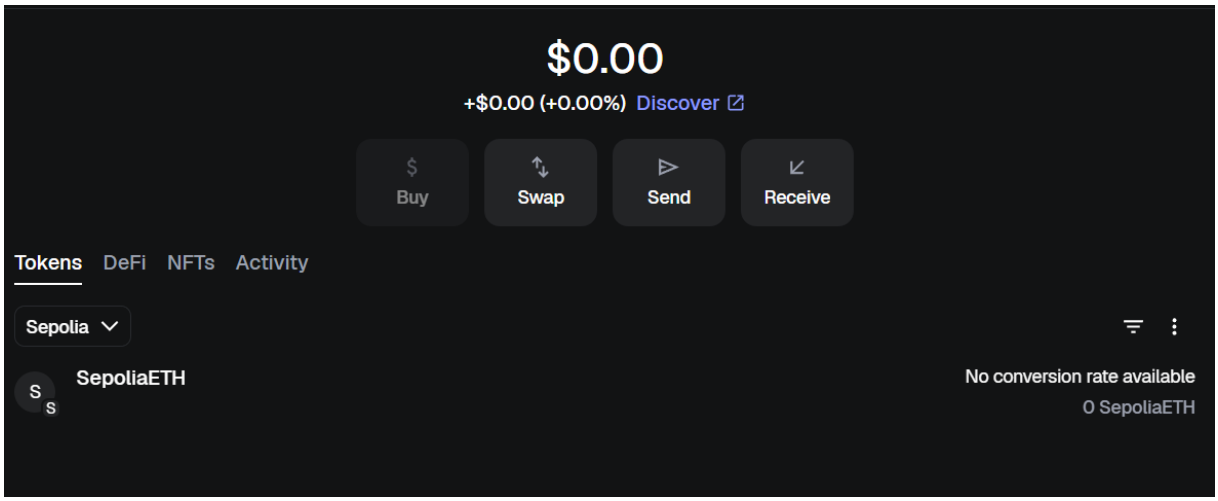
Screenshots:



Obtaining Testnet ETH Process:

I visited the Alchemy Sepolia Faucet and entered my wallet's public address to request free testnet ETH. Within a short time, the test ETH was credited to my wallet, confirming that the faucet transaction had succeeded. I then verified the transfer on the Sepolia Etherscan explorer using the transaction hash, which showed the sender, recipient, and confirmation details on the blockchain.

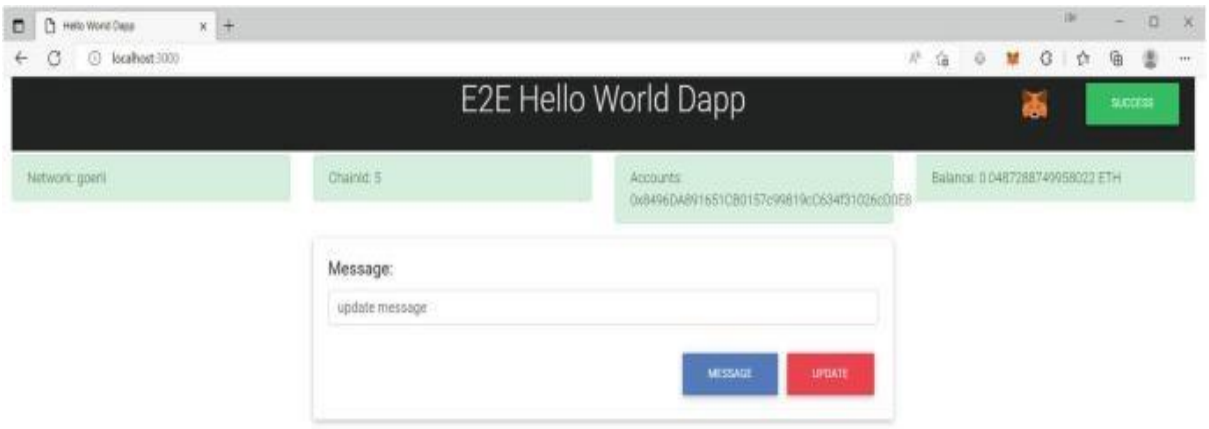
Screenshots:



DApp Interaction Process:

I accessed the Uniswap DApp on the Sepolia Test Network and connected my MetaMask wallet to the platform. Using the interface, I swapped a small amount of testnet ETH for testnet DAI to simulate a real token exchange. MetaMask prompted me to approve and confirm the transaction, which was then processed and verified on the Sepolia Etherscan block explorer. This step demonstrated how decentralized applications use smart contracts to execute secure, transparent, and trustless transactions.

Screenshots:



Etherscan Transaction Verification:

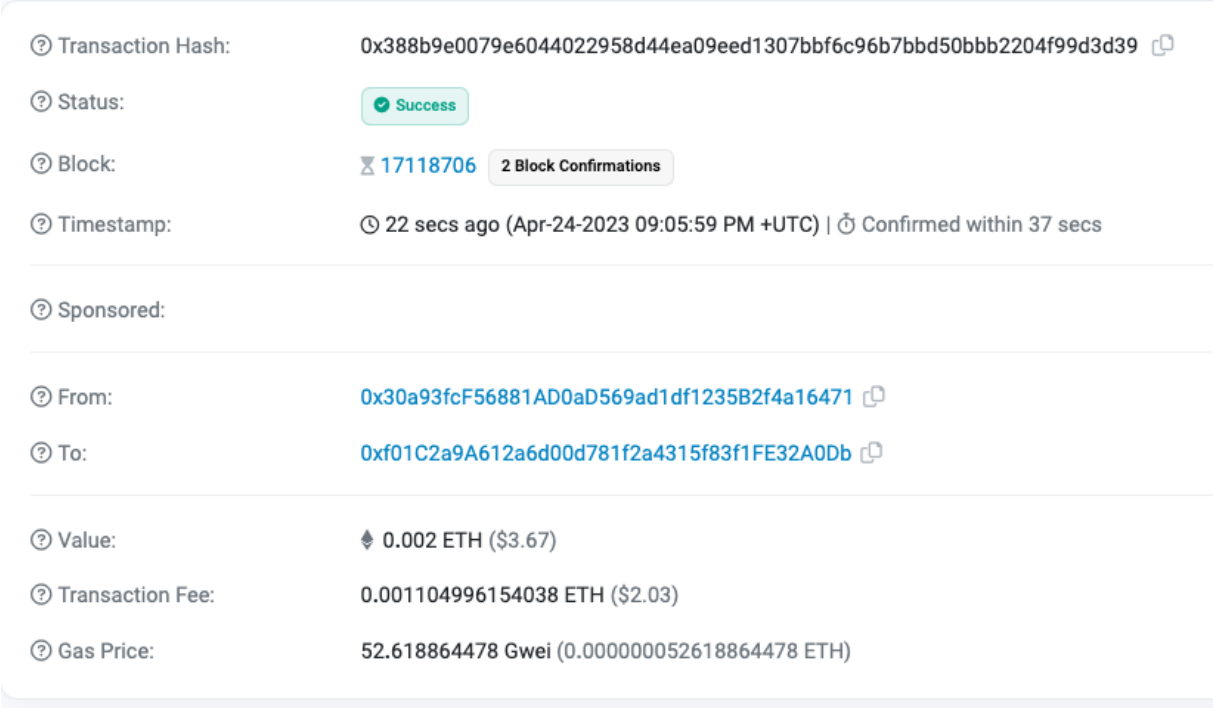
After completing the Uniswap token swap, I verified the transaction on the Sepolia Etherscan explorer. The explorer provided full transparency by displaying all on-chain details, including sender, receiver, and network fees.

Transaction Details:

- From: MetaMask wallet address (sender)
- To: Uniswap DApp smart contract address (receiver)
- Value: Amount of testnet ETH swapped for testnet DAI
- Gas Fee: Transaction fee paid to process and confirm the swap
- Status: Confirmed successfully on the Sepolia Test Network

This step helped me understand how every blockchain action is publicly traceable and permanently recorded for verification.

Screenshots:



Written Reflection

Blockchain and Web3 technologies mark a significant shift from centralized systems to decentralized ecosystems that give users full ownership and control over their digital assets and data. Through this hands-on project, I developed a clear understanding of how blockchains operate as distributed ledgers, recording transactions across multiple nodes to ensure transparency, immutability, and trust. Consensus mechanisms, such as Proof of Stake, maintain the network's integrity by validating transactions without relying on intermediaries.

Smart contracts emerged as one of the most powerful features of blockchain technology. These self-executing programs automatically enforce predefined rules and eliminate the need for third-party oversight. In my interaction with the Uniswap DApp, I experienced how smart contracts facilitate trustless transactions — from token approval to swap confirmation — all publicly visible and verifiable on the blockchain.

The distinction between centralized and decentralized applications became clear during this exercise. Traditional Web2 applications depend on central authorities and servers, while DApps operate on public blockchains, giving users direct control of their funds and participation in governance. When setting up MetaMask, I realized that my wallet, private keys, and assets were entirely under my custody, reinforcing the principle of user sovereignty in Web3.

Throughout the process, I maintained strong security practices: keeping my recovery phrase offline, verifying official URLs, and carefully reviewing transaction details before signing. One of the challenges I encountered was the delay in receiving testnet ETH from the faucet, which required patience and multiple attempts. I also faced a transaction error due to insufficient gas but successfully resolved it by adjusting the gas limit.

Overall, this project provided valuable practical experience in blockchain fundamentals, wallet management, and decentralized application use. I now feel confident navigating testnets, verifying transactions on Etherscan, and understanding the broader implications of decentralization for privacy, transparency, and digital ownership.

Technical Summary

- **Testnet Used:** Sepolia Test Network
- **DApp Used:** Uniswap (Testnet)
- **Transaction Type:** Token swap (ETH → DAI/USDC on Sepolia testnet)
- **Process Overview:** Connected MetaMask to the Sepolia Test Network, obtained test ETH from a faucet, and performed a token swap on Uniswap. Transactions were verified on the Sepolia Etherscan block explorer.
- **Errors and Troubleshooting:**
    - **Faucet Delays:** Some requests for test ETH took several minutes to process. The issue was resolved by retrying after a short interval.
    - **Gas Error:** One transaction initially failed due to insufficient gas. Increasing the gas limit in MetaMask resolved the issue.
    - **Verification:** All transactions were cross-checked and confirmed successfully on the Sepolia Etherscan explorer.