

**I'm not a bot**























Blockchain Development for Beginners: A Step-by-Step Guide the first time I tried to learn blockchain development, I felt overwhelmed. this tutorial you're reading is what I wish I could send back in time to myself. this will give you a strong foundation in blockchain development, and set you up for success in coding your own smart contracts. in addition to my explanation and code examples, i've included lots of videos you can use to supplement your learning. this tutorial assumes that you understand some foundational coding concepts. one of these that will be particularly helpful is the concept of object-oriented programming (oop). the blockchain is a network of transactions or assets called blocks where every block is connected to the others. everyone here has equal access to the data circling within the network. you can see blockchain as a document that holds the details of transactions made by a group of people where everyone has a copy. everyone must agree upon any updates before they are accepted. anyone who tries to mutilate their document without the others' consent is seen as fraudulent and will suffer predefined consequences. for example, imagine that a group of friends (njoku, samson, and eber) decides to start a peer-to-peer savings account that must run for a certain period before a withdrawal is possible. the three agree that no one will be the boss, and each person will have equal access to the account to ensure trust. so they open an account. each time one of them deposits money, everyone gets a new account history document emailed to them. whenever they decide to add a new member, the person becomes part of the signatories and gets a copy of the account history. everyone must consent before a withdrawal happens outside the proposed date. not following these terms will incur consequences such as losing all of a person's savings or leaving the association after paying a fine. blockchain is known as a decentralized technology since data and authority are shared equally among everybody in the network. it differs from centralized applications where the company owns the data, and the consumers just hope their data isn't misused. examples of decentralized applications include facebook and google. blockchain technology falls under the category of web 3 simply because it is the third phase of the internet in which users can read, write, and own data. web1 was the stage where users could only read data. web2 required some form of interaction. in the early 2000s and is the phase in which users can read and write data. this article i explain what happens in a blockchain application behind the scenes. we will begin by looking at how it works in the blockchain network. we will then replicate it using a programming language that many devs already know javascript. a blockchain is a connection of many blocks. so it begins with one block called the genesis block. among other things, blocks contain a hash, the previous block's hash, and at least one transaction. every block in the blockchain keeps a record of its hash and the previous block's hash to keep the network safe from hackers. this implies that for a hacker to gain access and break the network, they need to generate the hashes and match them to the right block without breaking other blocks. now that sounds really stressful and almost impossible, that is how secure blockchains are. next, any user on the network can perform at least one transaction. if the user has completed a set of transactions they need at a time, they can use those transactions to create a block. the block may now be added to the others. the whole process of adding a new block is known as mining. the process secures and verifies the transactions contained in a block. the hash of a block gets generated when mining. the process of calculating the hash is known as proof of work. let's use some javascript object-oriented programming to demonstrate how blockchain works. we are using the oop method because blockchain programming uses the same pattern. but before we start building, let's learn how to generate the hash for every block in a blockchain. there are a lot of libraries for generating a block's hash. but we will use the sha256 library for this tutorial. sha256 is the most popular and is used by many renowned companies. the sha256 library takes any data given to it and returns a 64-character long string. every string passed to the sha256 library will always return the same 64-character long string every time. you can check out and play around with it to see how it works. blockchains do not use just any hash generated because of security reasons. it specifies what the first few characters must look like for the hash to be accepted. this means that the hash will have to be generated several times, and a record of what changes on each iteration will be kept for reference purposes. for example, blockchain specifies that the only acceptable hash must contain three zeros at the beginning. to calculate the hash, we need to add the nonce known as a nonce to the string we specified while creating the hash. the nonce usually starts from zero and is incremented every time the hash is generated until a hash beginning with three zeros is found. then the hash and the nonce will be stored for reference purposes. the code below will calculate the hash for "man"; sha256("man").toString() however, we may run the function several times to get a string with three zeros at the beginning. since the function will always return the same result, we need to add a number to the string and increment it until we get the hash we want. the code we'd use for that will look like this: let hash = ""; let nonce = 0; while (hash.substring(0, 3) !== "000") { nonce++; hash = sha256("man" + nonce).toString(); console.log(nonce); console.log(hash); } ## #Looking forward to seeing everyone at the meeting tomorrow and discussing our strategies in detail. First, let's get back to demonstrating how blockchain works for our project. We need to create a directory called intro to blockchain and open it in a terminal. Then we run the following command and hit enter for all the prompts to initialize the project: npm init Create 2 files: blockchain.js and test.js by touching blockchain.js, test.js. We will use the blockchain.js file to write the code that emulates how blockchain works and use test.js to test the code and see the result in our system. In the blockchain.js, we have declared a class named Blockchain with the constructor function used to initialize the chain and pendingTransactions array. The chain array will contain every block or group of transactions added to the network, while the pendingTransactions array will hold all transactions that have not been added to a block. Now, let's build the createGenesisBlock function that only executes once because the constructor function runs only once - at the beginning of the program and does not carry any transactions. The next thing is to make a function to get the last block with the code below: getLastBlock() { return this.chain[this.chain.length - 1]}; This will enable us to access the details of the most recent block added. Let's now add the code to calculate the hash of a block which ensures that it works and install the SHA256 library by running the following command: npm install sha256 Import it at the top of your blockchain.js file like this: const SHA256 = require("sha256"); We will now add a function that creates our transactions and adds them to the list of pending transactions with the code below: createNewTransaction(amount, sender, recipient) { const newTransaction = { amount, sender, recipient }; this.pendingTransactions.push(newTransaction); }. The time has now arrived for us to build the last function - createNewBlock. It will enable us to add the pending transactions to a block, calculate the hash, and add the block to the chain with the code below: createNewBlock() { const timestamp = Date.now(); const transactions = this.pendingTransactions; const previousBlockHash = this.getLastBlock().hash; const generateHash = this.generateHash(previousBlockHash, timestamp, transactions); const newBlock = { index: this.chain.length + 1, timestamp, transactions, nonce: generateHash.nonce, hash: generateHash.hash, previousBlockHash: }; this.pendingTransactions = []; this.chain.push(newBlock); return newBlock; } The code above uses the getLastBlock function to access the previous block's hash. It calculates the hash of the current block, adds all the detail of the new block in an object, clears the pendingTransactions array, and pushes the new block into the chain. Let's export the Blockchain class to be able to access it outside the file: module.exports = Blockchain; We want to test the code we have written so far and see if it works as expected. We will navigate to the test.js file and begin by importing the Blockchain class that we exported a moment ago like this: const Blockchain = require("../blockchain"); Now, let's make an instance of it and name it bitcoin: let bitcoin = new Blockchain(); You may call it whatever you see fit, but I will use bitcoin because it is popular. Let's now see what we have in bitcoin by default. To do that, we will log it to the console like this: console.log(bitcoin); We will now open the project in a terminal and run the following command: node test It should output the following: Default Output In the output above, we have the chain array containing the genesis block and the pendingTransactions array containing nothing. You will recall that the constructor function contains all those data and it runs once at the beginning of the program. To add a new transaction, use the code below: To get the number of blocks added, click the getChainCount button. And just as we defined it, it returns a unit. There is just one item in the chain for now, but as you keep adding more blocks, the number will increase. Wait! Did we come this far? How Awesome! Congratulations on sticking to the end of this tutorial! You are now ready to explore all that you can do with blockchain. Blockchain is redefining the internet and has come to stay. The difficulty I encountered trying to learn the topics of this new technology moved me to document this beginner-friendly guide. I hope that it helps everyone still struggling out there. In this tutorial, you learned what blockchain is, how it works and what goes on behind the scenes. We demonstrated how it works using the OOP pattern of JavaScript and then concluded with a brief introduction to how to build smart contracts using the solidity programming language and remix IDE. I recommend that you keep learning and getting better at building blockchain applications by creating the following projects in the order they are listed (by increasing difficulty): Hello World Simple Storage Voting Smart Contract ERC20 Token Tether Wallet Air Drop ICO These projects will challenge you to do research and sharpen your blockchain skill. Happy Chaining! What is Blockchain Technology? Features of Blockchain? Why is Blockchain Important? What is Cryptocurrency? What is a Blockchain Wallet? What is Ethereum? Bitcoin vs Ethereum: Which One is Better? What is Ethereum Mining? What is a Smart Contract in Blockchain? What is Dogecoin? Dogecoin vs. Bitcoin Dogecoin Mining: Understanding The Fundamentals A Look into The Digital Dogecoin Wallet 5 Industries That Blockchain Will Disrupt in Future Emerging Blockchain Applications AcrossHow To Become a Blockchain Developer? What is NFT? The complete guide on Solidity Programming The Future of Shiba Inu Coin Understanding the Fundamentals of Ethereum Classic What is the Merkle Tree in Blockchain? What is Cardano? What is Matic Network? Top 30 Blockchain Interview Questions and Answers for 2022 What is Tether? A Comprehensive Comparison Of NFT Vs. Crypto What is Web 3.0? Types of Blockchain What is DeFi? What is Ripple? What is Binance? Blockchain Tutorial: Table of Contents Lesson 1: What is Blockchain Technology/Blockchain Transactions, Consensus, and Types of Blockchains ## #ENDARTICLEBlockchain technology has gained significant attention in recent years due to its potential to revolutionize various industries. 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Bitcoin is most prominent example in this segment. Blockchain 2.0: Smart Contracts The new key concepts are Smart Contracts, small computer programs that "live" in the blockchain. They are free computer programs that execute automatically and check conditions defined earlier like facilitation, verification, or enforcement. It is used as a replacement for traditional contracts. Blockchain 3.0: DApps DApps is an abbreviation of decentralized application. It has backend code running on decentralized peer-to-peer network. A DApp can have frontend Blockchain extant code and user interfaces written in any language that can make call to its backend. like traditional App, Blockchain Variants Public: In this type of blockchain, ledgers are visible to everyone on internet. It allows anyone to verify and add block of transactions to the blockchain. Public networks have incentives for people to join and are free for use. Anyone can use public blockchain network. 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Smart home sensors Self-driving car Personalized robots, robotic component Personalized drones Digital Assistants Health Data management Universal EMR Health databanks QS Data Commons Big health data stream analytics Digital health wallet Smart property Health Token Personal development contacts Network & Art Supercomputing Crowd analysis P2P resources Digital mind fit services Finance & Accounting Digital Currency Payment Payments & Remittance Decartelized Capital markets using network of computer on Blockchain Inter-dimensional accounting Clearing & Trading & Derivatives Bookkeeping Important Real-Life Use Cases of Blockchain 1.Dubai: The Smart City In year 2016, smart Dubai office introduced Blockchain strategy. Using this technology, it will allow worth of Billions of dollars worth of ERC20 tokens. The market tree is a data structure used in blockchain technology. It helps to ensure the validity of transactions and builds a tamper-proof record of all events that have happened in the system. cardano is a new blockchain platform that focuses on smart contracts, scalability, and decentralized applications. cardano is designed to provide a solution for three major problems faced by current blockchains: high transaction fees, slow processing times, and lack of flexibility. matic network is a blockchain-based platform that allows businesses to hire dapps to power their operations, with matic, companies can access the full range of features and capabilities offered by ethereum while still keeping their data isolated from the public network. Web 3.0 is all about shifting away from centralized control and embracing distributed ledgers, which will enable a more open and equitable web where users can trust their data is safe and transactions are secure. 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Furthermore, the decentralized nature of the network ensures that all nodes have access to the same information, making it challenging for malicious actors to manipulate the chain without being detected. Blockchain is a type of distributed ledger technology that enables secure, transparent, and tamper-proof transactions without the need for intermediaries. It uses advanced cryptographic algorithms to ensure integrity and confidentiality of data, making it an attractive solution for various industries such as healthcare, finance, and supply chain management. Blockchain Architecture: Understanding the Basics of Blockchain Blockchain technology has gained significant attention in recent years due to its potential to revolutionize various industries. However, it also requires high power consumption and complex hardware configurations, making it a challenge for widespread adoption. 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