A Seminar Report on

“BLOCKCHAIN TECHNOLOGY”

At



“Swarrnim Startup and Innovation University”,

Bharthana-Vesu, Surat

As A Partial Fulfilment for The Degree Of

**Bachelor of Computer Application**

2024-25

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This is to certify that the summer project entitled “” has been submitted by **LAKHANI SHUBHAM BHIMJIBHAI. Exam No. 2214103358** at Swarrnim Startup and Innovation University As a partial fulfilment of the requirement for the degree of **Bachelor of Computer Application** for the academic Year 2024-25.

**Place:** Gandhinagar

**Date:**

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**Acknowledgement**



The reason of completing the project work successfully is not just our efforts but efforts of many people. The people, who trusted us, guided us and encouraged us with every means. Guide is a person who provides you the direction towards success, so I feel great pleasure to express our gratitude to our guides, our faculty members as well as every person who helped us directly or indirectly with our project.

We are also indebted to our Professor **Asst. Prof. Dr. Hetal Modi** who provided constant encouragement, support & valuable guidance before and during our project. It was her effort who led us to this place for project work. Her guidance and suggestions were valuable.

We are also thankful to our all **Faculties Members** and specially to Our Principal **Dr. Vikram Kaushik** , to give us opportunity to make us this project.

Thank you very much,

**2214103358**

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## ⁕Introduction to Blockchain Technology ⁕

* Comparison: Blockchain vs Traditional Databases
* Architecture and Structure of Blockchain
* Working Mechanism of Blockchain
* Distributed Ledger Technology (DLT)
* Key Properties of DLT
* Blockchain Hashing – Concept and Importance
* Classifications: Types of Blockchains
* Real-World Applications of Blockchain
* Challenges and Disadvantages of Blockchain
* Understanding Cryptocurrency
* Bitcoin – The First Cryptocurrency
* Technical Working of Bitcoin
* Security Aspects of Bitcoin and Blockchain

**1. Introduction**

* Blockchain is one of the most transformative technologies of the 21st century, redefining how data is stored, verified, and exchanged.
* It is essentially a distributed ledger technology that stores data in a chain of blocks.
* Each block is linked to the previous one using cryptographic techniques, ensuring data integrity, transparency, and immutability.
* What makes blockchain revolutionary is its decentralized nature — no single authority or entity controls the system.
* It offers a trustless environment where transactions and data exchanges can occur securely without intermediaries.

**2. Evolution and History of Blockchain**

* The origins of blockchain date back to the early 1990s:

**1991-2008:**

* The groundwork was laid by cryptographers who developed the concept of a chain of blocks secured through cryptography. In 2008, Satoshi Nakamoto proposed Bitcoin, combining cryptographic principles with decentralized networks.

**2009:**

* Bitcoin was officially launched, introducing blockchain to the world.

**2011–2013:**

* Interest grew in blockchain for uses beyond cryptocurrency, such as digital contracts and secure voting.

**2017–2018:**

* Enterprise adoption increased, with companies developing their own blockchain solutions.
* Today, blockchain is used across industries including finance, healthcare, education, supply chains, and government.

**3. Blockchain vs Traditional Databases**

**Blockchain:**

**Decentralized:**

* No central control; managed by multiple nodes.

**Immutable:**

* Data cannot be altered once added.

**Confidentiality:**

* Ensures security using encryption and consensus.

**Insert-only:**

* Only supports addition of new data.

**Trustless:**

* No need for intermediaries.

**Slower:**

* Due to consensus and verification mechanisms.

**Traditional Databases:**

**Centralized:**

* Controlled by a single authority (admin).

**Mutable:**

* Data can be edited or deleted.
* Less secure: Prone to data tampering if compromised.

**Full CRUD:**

* Create, Read, Update, Delete operations supported.

**Faster:**

* Especially for bulk processing or queries.

**Relies on trust:**

* Requires admins to maintain integrity.

**4. Architecture and Structure of Blockchain**

Each block in a blockchain contains:

**Header:**

* Includes metadata such as timestamp, nonce, and hash of the previous block.

**Transaction Data:**

* List of validated transactions.

**Merkle Tree:**

* A data structure that summarizes transactions for verification.
* The first block is known as the Genesis Block. As new blocks are added, the chain grows, and the integrity of the entire blockchain is preserved.

**Key Features:**

* Decentralization ensures fault tolerance.
* Transparency via public access.
* Security through hashing and consensus.

**5. How Blockchain Works – Step-by-Step**

* A transaction is initiated by a user.
* The transaction is broadcast to a network of peer-to-peer (P2P) nodes.
* Nodes validate the transaction using a consensus mechanism (e.g., Proof of Work).
* A new block containing the transaction is created.
* The new block is added to the chain.
* The transaction is now permanently recorded and visible to all.
* This makes blockchain tamper-proof and auditable.

**6. Distributed Ledger Technology (DLT)**

* DLT is the broader term under which blockchain falls. It is a database distributed across multiple locations, ensuring redundancy and resilience.

**Features:**

* Peer-to-peer architecture
* No central data store
* Records synchronized across nodes
* Use of consensus algorithms to verify transactions

**7. Key Properties of DLT**

**Time-stamped:**

* Each block is accurately recorded.

**Immutable:**

* Once entered, data can’t be altered.

**Distributed:**

* No central server; all nodes hold full records.

**Secure:**

* Uses encryption and digital signatures.

Anonymous or Pseudonymous:

* Users are not required to reveal their identity.

**Programmable:**

* Smart contracts automate processes.

**8. Blockchain Hashing**

* Hashing is the transformation of input data into a fixed-length string using a hash function.
* Guarantees data integrity
* SHA-256 is the most common hash function used
* Even the smallest change in input alters the hash significantly
* Hashing links the blocks together and makes tampering almost impossible.

**9. Classifications: Types of Blockchains**

**1. Public Blockchains**

* Open for anyone to participate.
* Transparent and decentralized.
* Examples: Bitcoin, Ethereum

**2. Private Blockchains**

* Restricted access; controlled by a central authority.
* Used in organizations for internal purposes.

**3. Hybrid Blockchains**

* Combines public and private features.
* Allows selective transparency.

**4. Sidechains**

* Run parallel to a main blockchain.
* Used to improve scalability and efficiency.

**10. Real-World Applications of Blockchain**

**Banking & Finance:**

* Fast, secure cross-border payments.

**Healthcare:**

* Secure sharing of patient records.

**Supply Chain:**

* Track origin and movement of goods.

**Voting:**

* Transparent, tamper-proof digital elections.

**Education:**

* Tamper-proof certificates and records.

**Legal:**

* Digital contracts and notarization.

**Real Estate:**

* Property title verification.

**11. Challenges and Disadvantages of Blockchain**

**Scalability:**

* Current systems can handle limited transactions per second.

**Energy Consumption:**

* Mining requires massive power.

**Complexity:**

* Technical barriers for users and developers.

**Regulatory Issues:**

* Legal frameworks are still evolving.

**Irreversibility:**

* Once data is in the chain, it cannot be removed.

**Cost:**

* Setting up a secure blockchain infrastructure is expensive.

**12. What is Cryptocurrency?**

* Cryptocurrency is a digital currency that uses blockchain for decentralized and secure transactions.
* Not issued by any central authority.
* Based on encryption techniques.

**Examples:**

* Bitcoin
* Ethereum
* Litecoin

**Advantages:**

* Global access
* Low transaction costs
* Transparency

**Disadvantages:**

* Volatile prices
* Limited acceptance
* Security risks if poorly managed

**13. Bitcoin -The First Cryptocurrency**

* Introduced in 2009 by Satoshi Nakamoto.
* Operates on a public blockchain.
* Total supply: 21 million coins.
* Transactions are verified through mining.
* Used as both a currency and a store of value.

**14. Technical Working of Bitcoin**

**Wallet Creation:**

* Users create a digital wallet.

**Public Key Sharing:**

* Wallet generates an address (public key).

**Transaction Initiation:**

* User sends/receives Bitcoin.

**Mining and Verification:**

* Miners validate transactions.

**Block Addition:**

* Validated blocks are added to the blockchain.

**Permanent Record:**

* Immutable and publicly visible.

**15. Security Aspects of Bitcoin and Blockchain**

* Blockchain is secure by design due to decentralization.
* Attacks are difficult due to network consensus.
* Storage remains a weak link — securing wallets is essential.
* Most hacks happen at exchange level, not on the blockchain.

**16. Conclusion**

* Blockchain has emerged as a breakthrough technology with vast applications beyond cryptocurrencies. Its decentralized, immutable, and secure design opens up new possibilities for industries and individuals alike. It empowers users by eliminating middlemen, enhancing transparency, and ensuring data integrity.
* From banking to healthcare, and supply chains to education, blockchain is already transforming traditional systems. While challenges like scalability and regulation remain, the future of blockchain holds immense promise.

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