DEDOC

APPLYING FEDERATED LEARNING WITH SMART CONTRACTS IN HEALTHCARE

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Objectives

- **Provide a Coordination Platform for Healthcare Sector**
- **Allow Model Sharing between hospitals through Federated Learning**
- **Develop a Secure mechanism , upholding security and privacy of all participants**
- **Use Smart Contracts as a Protocol Enforcing Entity to maintain Integrity and Trust between all Hospitals**
- **Achieve Interoperability between Blockchain and AI**

What is Federated Learning ?

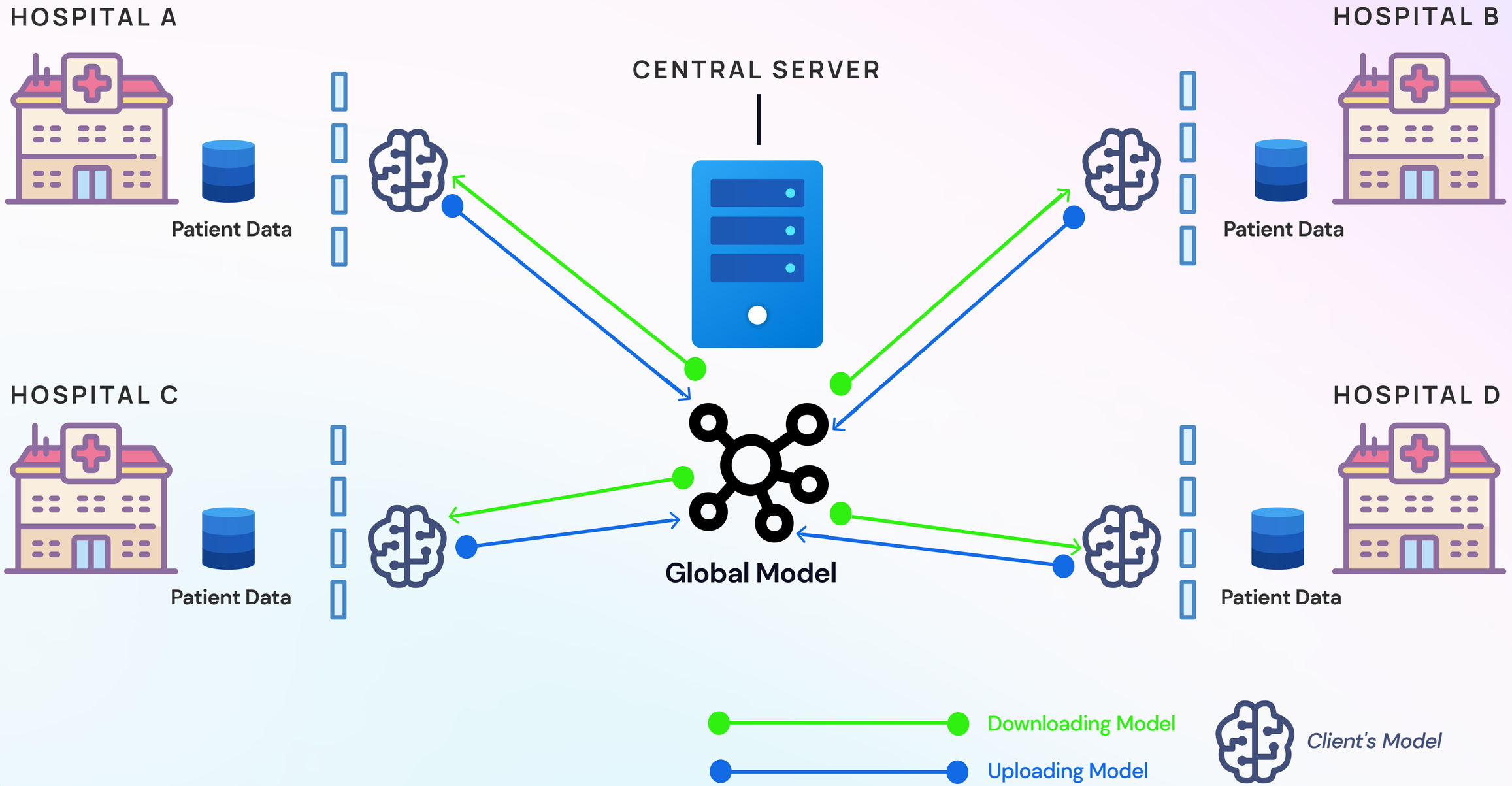
WHAT THIS SECTION IS ALL ABOUT

Federated Learning

Federated learning (FL) is a learning paradigm seeking to address the problem of data governance and privacy by training algorithms collaboratively without exchanging the data itself.

As all ML methods benefit greatly from the ability to access data that approximates the true global distribution, FL is a promising approach to obtain powerful, accurate, safe, robust and unbiased models. By enabling multiple parties to train collaboratively without the need to exchange or centralise data sets, FL neatly addresses issues related to egress of sensitive medical data

WORKFLOW OF FL IN HOSPITALS



Pros and Cons of Federated Learning

- Computations moved to end-user devices
- Better model accuracy because of having access to various data
- More secure apps – we are not transferring user data to a server
- We can learn many models simuntenaously at low cost

- FL is worth to use only if end-user device has various data and data should not be transferred out of the device
- AI Model verification can become hard because of training “without” data
- Federated learning is known to be vulnerable to both security and privacy issues

The challenge faced during federated learning is secure transmision of data

HOW THIS PROBLEM CAN BE SOLVED ?

BLOCKCHAIN

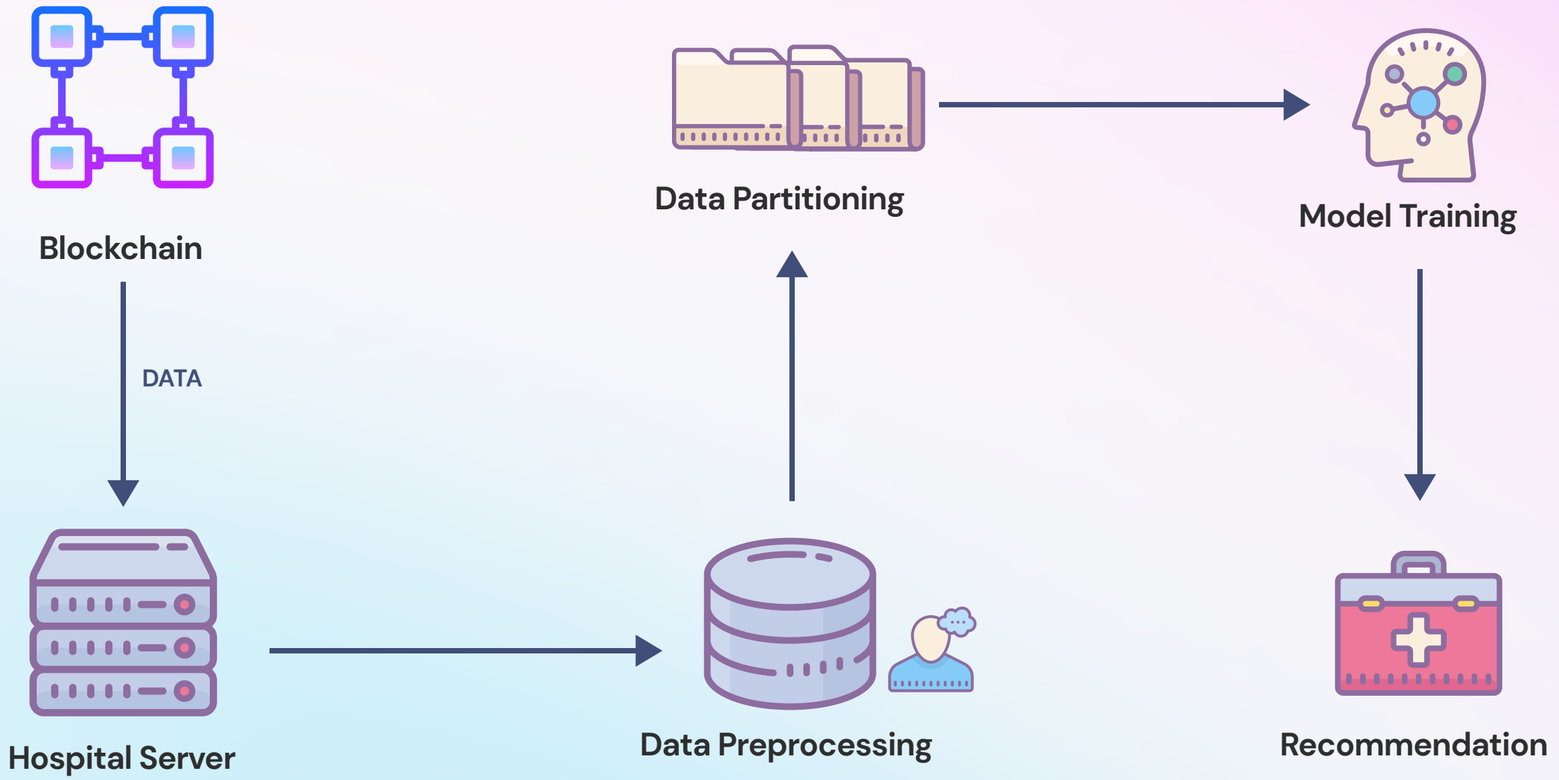
Why do we need to use Blockchain ?

Blockchain is a revolutionary technology that is applicable in all fields. It provides the storage area with assured privacy and security. It has many useful features like immutability, a digital ledger concept, and a decentralized concept. Blockchain is based on a consensus algorithm and smart contract.

The first and foremost goal of blockchain is to store the data in the transaction and provide privacy and security for those transactions. All the blocks contain multiple transactions in it. All those transactions are validated by the miners, and in return, they get rewards. The proposed architecture is shown in the figure. The proposed work is of two parts:

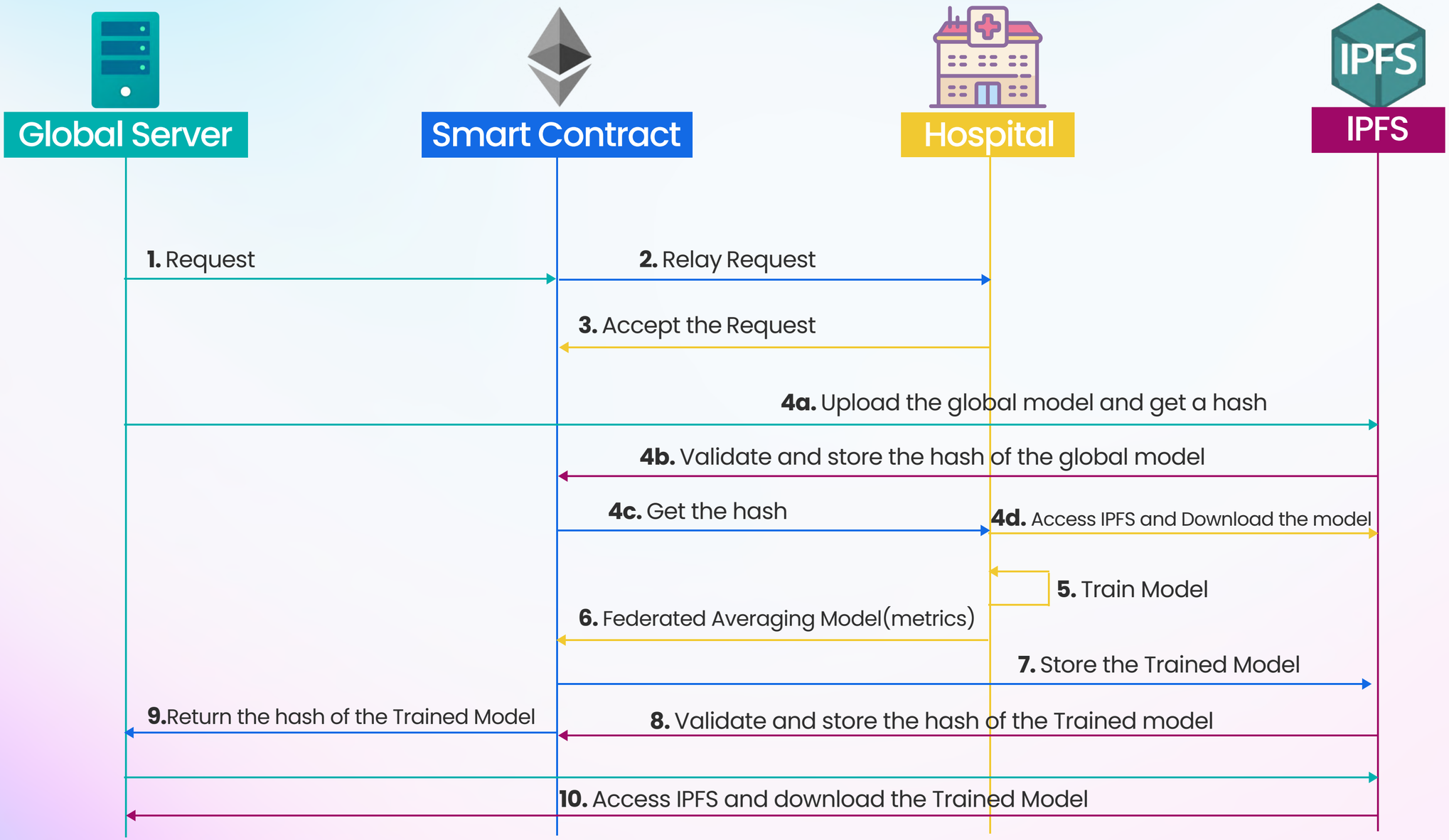
1. EHR(Electronic Health record) saved in blockchain by different hospitals and clinics in the blockchain.
2. Models collected from different hospitals using federated learning and saved to a central server.

Details about the Workflow and Integration of Blockchain with Federated Learning



Sequence Diagram

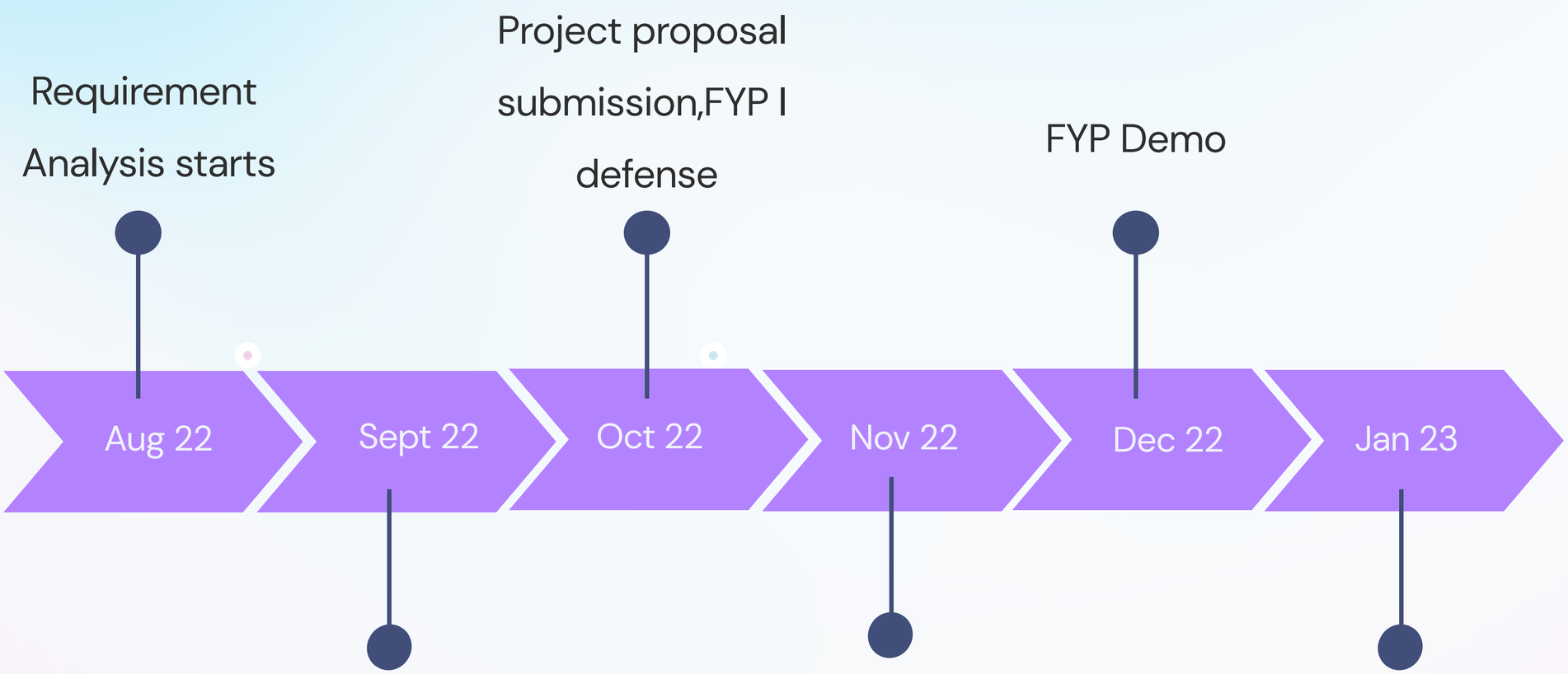
SCENARIO : A Global Server requesting a hospital to send it's locally trained model



Technology and Frameworks to be used

- Smart Contracts (Solidity)
- HardHat (framework for solidity)
- React (Frontend Library)
- Web3.js(Connecting our Smart Contracts)
- Nodejs (Defining Backend Logic)
- Mocha and Chai (Testing Smart Contracts)
- Selenium (Testing Frontend)

And here is a caption for this video


Requirement Analysis starts
Project proposal submission,FYP I defense
FYP Demo
Aug 22
Sept 22
Oct 22
Nov 22
Dec 22
Jan 23
Finalizing design phase, moving towards implementation
Implementation continued, Mid II approaches
SRS/SDS submission, Finals, FYP I Deliverable

Project Deliverables

FYP-I

- SRS Document
- Prototype(Wireframes)
- SDS Document
- Front-End Codebase
- Blockchain Boilerplate code

Thank you