Project Plan Presentation
Blockchain Based Vaccine Passport System
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Functional Specifications

- Secure, verifiable "vaccine passports" are essential for public safety amidst the COVID-19 pandemic.
  - By verifying individual's vaccination statuses, the risk of spreading the virus via travel, sporting events, concerts, etc. can be minimized.
  - Paper vaccination cards are easy to fake and could put the public at risk.
- By leveraging the immutable nature of the blockchain, secure digital "vaccine wallets" can be verified.
  - The goal of this project is to create a system that allows users to easily display vaccination status and request updates.
  - A verified medial entity will approve and record vaccine status of users to the blockchain to ensure authenticity.
- The system should support users that don't want a wallet.
  - These users will not have the benefits of the blockchain.
Design Specifications

• Admin Application
  ▪ User registration approval
  ▪ Vaccine update approval

• User Web Application
  ▪ Register an account
  ▪ Request update to vaccine status
  ▪ View vaccine status

• User Wallet Application
  ▪ Register wallet account
  ▪ Request update to vaccine status
  ▪ View vaccine status
Screen Mockup: Vaccine Data Collection
Screen Mockup: Administrative Dashboard
Screen Mockup: Registration Requests
Screen Mockup: Vaccine Update Requests
Screen Mockup: Current User Vaccine Status
Screen Mockup: User Vaccine History
Technical Specifications

• Spring boot API
  ▪ Interface for communicating with the database
  ▪ Interface for interacting with administrative wallet
• Angular frontend
  ▪ Web based interface for users (with or without an Ethereum wallet) and admins
• Smart contract
  ▪ Interface to the Ethereum network
  ▪ Functions to read and update the Ethereum network
• Ethereum wallet (Store for cryptographic information)
  ▪ Administrative wallet
    o Performs reads and writes on the blockchain using the smart contract
  ▪ User wallet
    o Implemented as a java application
    o Performs only reads on the blockchain using the smart contract
• PostgreSQL database
System Architecture

Blockchain Based Vaccine Passport System

Frontend
- Web frontend
- User Wallet (Android)

Backend
- PostgreSQL Database
- Admin wallet

API (Spring boot)

Ethereum Blockchain
- Smart Contract

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System Components

• Hardware Platforms
  ▪ Android

• Software Platforms / Technologies
  ▪ Front End
    o HTML
    o CSS
    o Angular
    o Typescript
  ▪ Back End
    o Spring Boot
    o PostgreSQL
    o Solidity
    o PGAdmin
    o Java
    o Remix IDE
    o Web3j
    o Truffle
    o QuickNode.io
  ▪ Environments
    o AWS Server
Risks

• Efficiency
  ▪ **Description:** Fees are associated with transactions that add blocks/make changes to the Ethereum network. As such, we need to optimize smart contracts to reduce gas fees.
  ▪ **Mitigation:** Our smart contracts will be tested extensively on Ethereum network simulators to ensure that we pay the least possible gas fee.

• Security
  ▪ **Description:** Different authentication protocols have been developed over the past years (e.g., OpenID Connect, SAML, etc.). We need to settle down on one of them or an authentication service provider and avoid reinventing the wheel to better protect user data and secure our APIs.
  ▪ **Mitigation:** We will immediately find a library that provides the best support for one of the authentication protocols and implement that as soon as possible. If no such library exists, we will resort to an authentication service provider (e.g., Auth0). We will be using elliptic curve cryptography and digital signatures for securing communication between clients and the backend web service. We will also encrypt all information sent across the internet thus providing an additional level of security aside transport layer security.
Questions?