

Documentation: Team Orange

“A fertile soil alone does not carry agriculture to perfection.” – E. H. Derby

High Level Overview

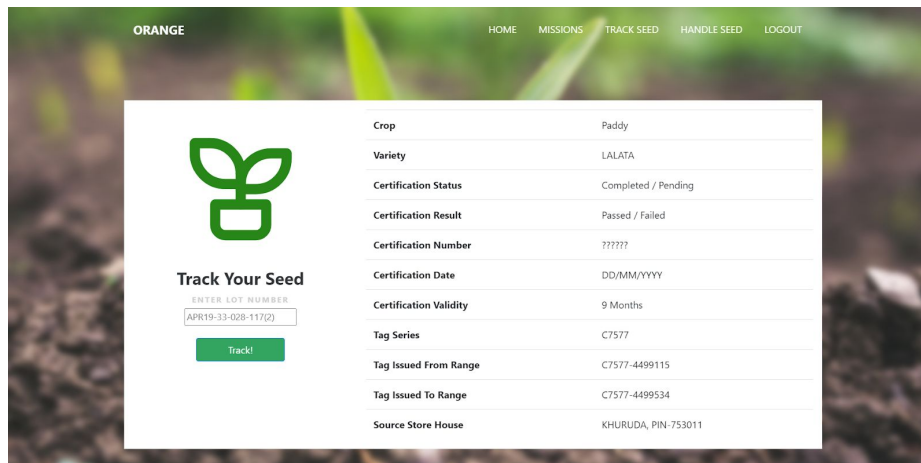
Goal: Our application allows for seamless end to end tracking of a seed from the seed grower to the farmer.

- Our architecture consists of the following
 - **Frontend:** Login, register pages for all organizations involved. Data entry pages for SPA, STL and SCA.
 - **Backend:** Communicates between the frontend, SQL databases and blockchain for data storage.
 - **Databases:** SQL and NoSQL databases for storing login information and any extra seed information which is not required to be stored on the blockchain.
 - **Blockchain:** Stores and tracks all seed information along with the history.
 - **Security and transparency:** The blockchain cannot be tampered with and the entire history of changes is available. Only the required information is shown to the organizations using blockchain channels.
 - **Analytics & Prediction:** Predict features like fertility status using nutrient index.
 - **Feedback & Trust Scoring:** Collect feedback from the farmer. Based on the feedback of many farmers, we calculate a score.

User Interface

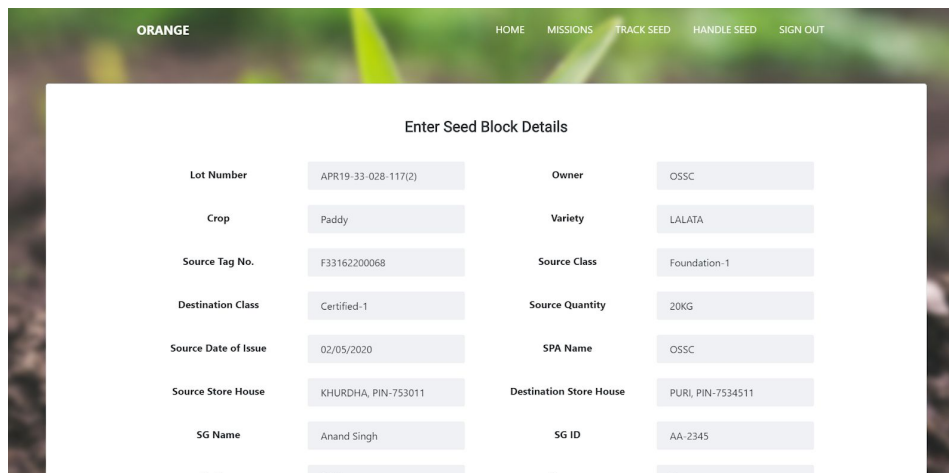
A single web app has been hosted to handle all kinds of end users like SPP, SPA, SCA, SG, farmer etc.

A farmer and a seed grower have similar UI as both have to track the seed lots related to them. They need login and then go to the seed tracker. They can track, see details of the seed slot related to them by using the allotted “Lot Number”.



Crop	Paddy
Variety	LALATA
Certification Status	Completed / Pending
Certification Result	Passed / Failed
Certification Number	??????
Certification Date	DD/MM/YYYY
Certification Validity	9 Months
Tag Series	C7577
Tag Issued From Range	C7577-4499115
Tag Issued To Range	C7577-4499534
Source Store House	KHURDHA, PIN-753011

SPP and SPA can be created while SCA, STL and Store Houses can update Seed blocks using the “Handle Seed” Section. This section provides different forms based on the type of Agency.



Lot Number	APR19-33-028-117(2)	Owner	OSSC
Crop	Paddy	Variety	LALATA
Source Tag No.	F33162200068	Source Class	Foundation-1
Destination Class	Certified-1	Source Quantity	20KG
Source Date of Issue	02/05/2020	SPA Name	OSSC
Source Store House	KHURDHA, PIN-753011	Destination Store House	PURI, PIN-7534511
SG Name	Anand Singh	SG ID	AA-2345
Fin Year	2020	Season	Summer

Cloud database & Backend

Overview

- Oracle Cloud service is being used to manage the registration data and other important/extra details about the seeds.
- We are using a NoSQL database to store all the data since it is more flexible as the data we are storing can be very varying and we may not always have all the required fields.
- NoSQL databases are also famous for being more easily scalable and much more flexible when compared to SQL databases.

Technical Details

We are using the oracle python sdk because it would be easy to integrate with our flask server.

Follow the setup as mentioned in the official oracle [docs](#).

There are three main tables:

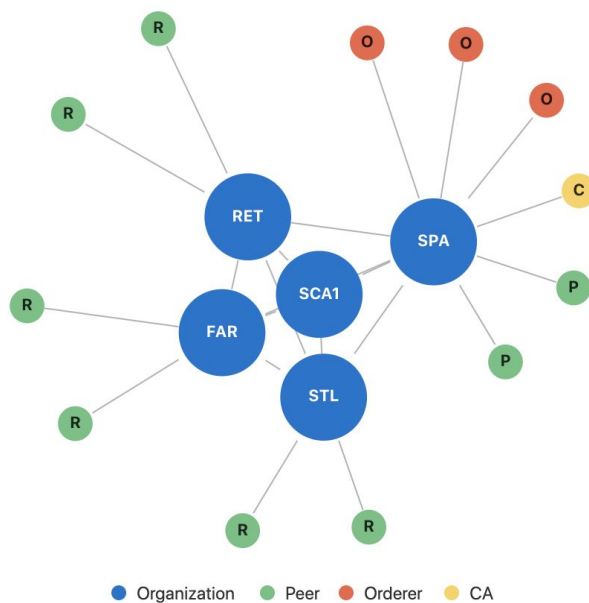
1. One table holds all the registration details of all the users who register. Regardless of the type of user, the fact that we are using a nosql database allows us to append all details into this single table.
2. Second table holds complete details of all the seeds with TagNO as the primary key. We can accommodate any number of parameters in this table, as it has only 2 columns. One, being the primary key and the other being a json object containing all the details.
3. Third table contains details of all the reviews and feedback of all the farmers which also has LotNo as the primary key.

Blockchain

The blockchain is hosted on Oracle Cloud Blockchain platform which is based on the Hyperledger Fabric distributed ledger system.

The following Organizations were created in the Blockchain platform:

- SPA
- SCA
- STL
- FAR
- RET



Each of the organizations have 2 peers.

Every organization is connected by channels.

Each channel has a chaincode associated with it. The chaincode is implemented using the Hyperledger Fabric SDK written in the Go language.

Intelligence

- Soil Fertility: We calculate the quality of soil from the soil fertility index provided by the user. We also calculate a trust score for a particular user by prompting them to enter the fertility class. We compare their entered fertility class to our calculated fertility class. If they are the same, we assign a truth score of 1. If they are not we assign a score between 0 and 0.5 depending on various conditions.
- Feedback Mechanism: Every distributor provides a farmer with a OrderID. Using this order ID, we take feedback from a farmer who is growing the seeds about the seed quality. We then score the entire batch of seeds based on a score of 1-5 with a comment. For every good/bad score, we try to fix the root issue by having a scoring system for STLs, distributors and seedGrowers based on the feedback by the farmer. Currently, it is a rule based system, but as we are able to collect more data and with time, it will transition into a robust ML system. The sentiment analysis is done using NLP techniques to get a polarity score which is then averaged over a particular STL/distributor/seedGrowers to give the necessary outputs.

Human in the Loop AI System

```
def scoring(score, comment, distributorName, certified, stlName, seedGrowerName, lotID, orderID):
    """This function computes a score for distributors, seedgrowers, sentiment of farmers and stl.
    | For the sentiment, we use SOTA nlp packages.

    param score: score provided by farmer
    param orderID: orderID provided by farmer
    param comment: comment by the farmer on the seed quality

    Return type:Dict
    Returns: {
        "stl":stlScore,
        "dis":distributorScore,
        "sg":seedGrower,
        "sentiment":sent
    }
    """
```

Code with documentation

OrderID	14CAK	19KOPO	19BNGA
Avg STL Score	4	3	1
Avg Distributor Score	3.5	3	3
Average Seed Grower Score	3.8	3	5
Average Sentiment	Positive	Positive	Negative

Sample Scoring