System Solution

Software Engineering (T-303-HUGB)
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Repository

We set up **continuous integration (CI)** pipeline automation in the repository using GitLab yml. This allowed us to automatically make sure all our tests passed before any integrations were made in the project. No failed pipelines can be merged in the repository.

Furthermore, we restricted all developers from merging their own code. That meant that for every merge made there had to be a person reviewing the code alongside the CI verification.

Software Structure

We have **layered our system extensively** to make sure that components are individually replaceable and updatable. This has benefited us greatly in the continuous (agile) development process.

The software needs to be continuously updated according to ever new standards and having our software separated into **smaller components that are loosely coupled** makes the complexity of the changes less drastic.

Furthermore, this has made our system more **manageable** for a group our size and allowed for **easier distribution of workload**.

Work distribution

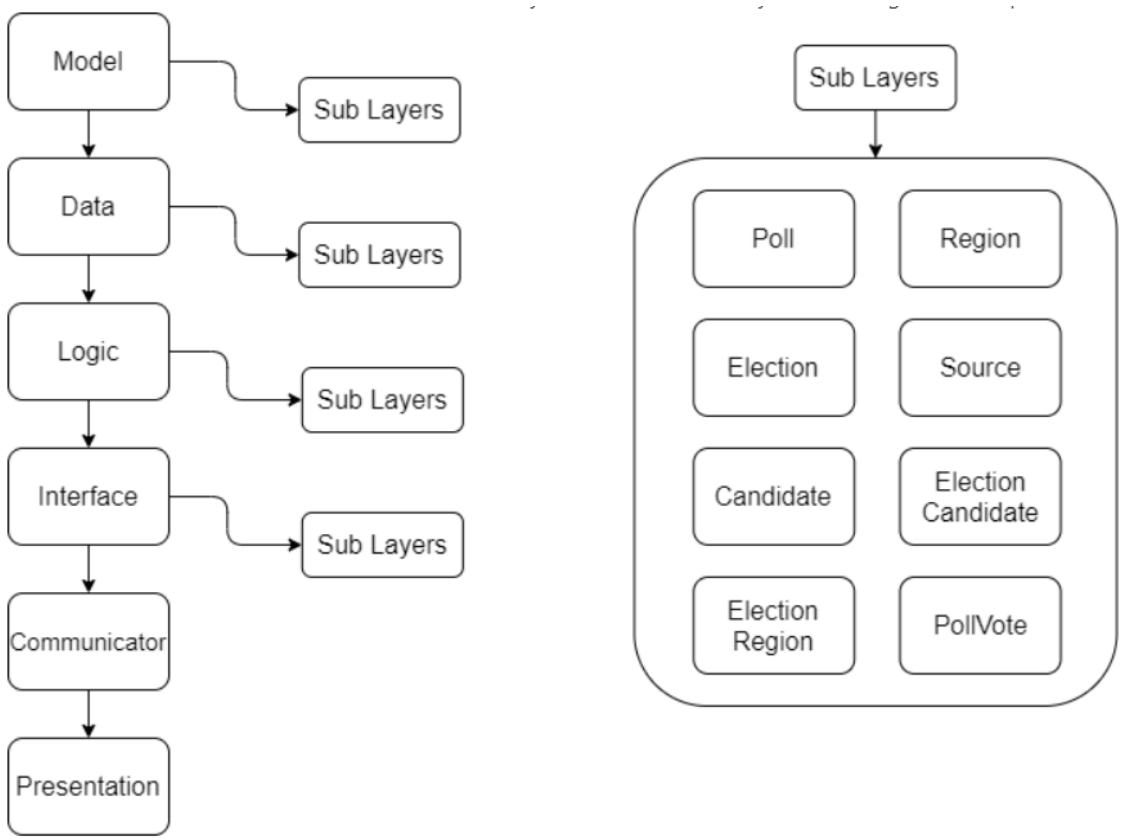
Having our project well layered allowed us to distribute work between team members in whichever section of the project they deemed fit, without having much of an impact on others.

Design patterns in system

Within most of our software we make use of the SOLID principals.

Layered Architecture

As mentioned in the software structure section, the system is divided into layers. The image below depicts the current layering.



Singleton pattern

In the interface we have a class called **Communicator** which handles all websocket communication. This class prevents more than one instance of it to exist at runtime.

Factory pattern

The factory pattern is a direct result of the layering done within our system. This makes our code more compact and reusable. The factory pattern in our data layer is depicted in the code demo below, however this is valid for the logic and interface layer as well. The displayed methods and attributes from the class "Data" are inherited by child classes such as class Poll(Data).

The parent class:

```
class Data:
       # Some methods removed for simplification
       def __init__(self):
           self.idf = 0  # The current largest ID in the list

       def add(self, model_object):
           """Add a model object to the database"""
           # removed for simplification

       def get(self, _id: int):
           """Get model data by id"""
           # removed for simplification

       def get_all(self):
           """Get all model data"""
           # removed for simplification

       def delete(self, _id: int):
           """Remove model data by id"""
           # removed for simplification

       def update(self, model_object):
           """Update a model"""
           # removed for simplification
```

The child class:

```
class PollData(Data):
    def __init__(self):
        super().__init__()
        self.data_path =
self.get_filepath("../json_data/poll_data.json")
        self.idf = self.get_idf()
    # Inherits methods for add/update/delete/get/get_all ...
```

Facade pattern

As an example of a facade pattern we can take our authentication package. It is a component integrated into the system using a simplified interface, which masks over the complicated tasks below. This is also intentional to prevent tampering of authentication where it should not be possible from the outside. We provide simple usability and prevent usage without those methods. (For reference you can read the README.txt in the auth package)

Observer pattern

Our communicator class implements the observer pattern. It keeps a list of all it's dependents (mainly the interface classes) and calls their methods in an appropriate manner according to the websocket request. This drastically simplifies the method mapping and overall usage of our websocket implementation.

Data mapper pattern

To simplify and organize the usage of data we are taking advantage of model classes or data mappers. These classes map the data to and from the database. When we write new data to the database, we use a method within the models for transforming a model to it's database representation, and when we fetch data from the database we transform them to models with a method within the model.

Refactor possibilities

The data storage

The data storage choice is definitely not ideal for scalability and the amount of data generated by the software. Ideally, we would move to any type of SQL storage. This would require only a few changes to the fetch/update methods in the data layer parent class.

The interface data adapter

Ideally, we would have a separate component that adapts data to the front ends requirements. Currently we have methods for this in each logic layer. However as of right now the required data in the front end is pretty over complicated with cross references between our models making it quite a leap to create a data adapter.

Testing approach

We would like to have our test automated and possibly more standardized. By having at least a part of the tests automated the errors would be fixed by the automation tool and on the same to look for similar errors. By standardized the test via IEEE-829 standards or similar standards the test would have better structure, higher coverage and would result in a better product.