

# Summer Internship Project Report

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Summer Internship 2022

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## 1.1 Introduction

This report outlines my work as part of my summer internship at the Software Engineering Research Center, IIIT Hyderabad from 15th May-30th June 2022.

## 1.2 Objective

- Suggest some aesthetic improvement to the Conference website.
- Learn about Session Types for Smart Contract.
- Design a framework for displaying standard Data-Structures and use it to build a package for displaying Array.
- Learn about state transition system to build algodynamics website.

## 1.3 Work Done

The detailed description for each task is given below.

### 1.3.1 Customizable Calculator

This task is concerned with designing and building simple web-based calculator program. The calculator is capable of dynamically adding new buttons and change its aesthetic properties with the help of parameters passed.

The customizable features of the calculator are:

- **fontStyle**: This can be used to change the font style of the text in the calculator.
- **noOfButton**: This is used to set the number of buttons in the calculator.
- **padding**: This is used set the padding of the button.
- **shapeType**: This can be used to change the shape for the calculator.

The objective of the task was to test the understanding of Elm programming language. The other objective of the task was to understand the model update architecture of Elm. The task helped me to test my proficiency in Elm programming language. The gitlab repo for the calculator [here](#).

### 1.3.2 Documenting the features of the Elm-Dagre Attributes

This concerns the task of documenting the features of Elm Dagre. After studying Elm Dagre source code, the following design decisions were clarified:

- Why Dagre and Render Attributes are separated.
- Understanding various Dagre and Render attributes.
- The design decision to introduce custom drawer function to increase portability.
- Understanding of various Dagre and Render attributes.

Apart from this the study of Elm-Dagre was beneficial as a case study for the implementation of non-trivial Elm program. The insight gained from the study of Elm Dagre was also beneficial in reduction of problem of different view of the data structure to a graph problem. The documentation repository link is [here](#).

### 1.3.3 Array view Implementation

This task was concerned with building a view for array data structure. The problem of building view of array was reduced to building an appropriate graph for an array. Then the appropriate graph was rendered using the elm-dagre graph module. Apart from the attributes that are directly provided the other attributes was:

- **elemWrap**: This property could be used to wrap the elements of the array.
- **elemDistX**: This can be used to set the elements distance in x axis.
- **elemDistY**: This can be used to set the element y distance in y axis.

The implementation of this exercise is beneficial in building a final project which will be used in the production of algo-dynamics web-site. The repository link is [here](#).

### 1.3.4 Elm Data Structure Package

This task is concerned with building the drawer function for array data structure that will be used for production in the algo-dynamics site. The task accommodates the ability to add custom drawer for elements increasing its flexibility.

The primary objectives of the package are as follows:

- To design and implement a custom drawer function in pure Elm which takes in a user defined array as a parameter and outputs a clean representation of it in an SVG container.
- To make the visualizing of an array seamless and minimalistic.
- To allow the user to add their own custom attributes to modify the rendered output, without any inconvenience.

This package is consistent with the current version elm-dagre. This repo link to package is [here](#).

### 1.3.5 Learning about Smart Contract for Session Types

Read about a paper partially on Resource Aware Session Type for Digital Contract [1]. Digital contract are computer programs that describe and enforce the execution of the contract. The paper points out that contract language derived from general purpose programming language are inadequate to accommodate the domain specific requirement for digital contract. This is because:

- Instead of centering contracts on their interactions with users, the high-level protocol of the intended interactions with a contract is buried in the implementation code, hampering understanding, formal reasoning, and trust
- Resource (or gas) usage of digital contracts is of particular importance for transparency and consensus. However, obliviousness of resource usage in existing contract languages makes it hard to predict the cost of executing a contract and prevent denial-of-service vulnerabilities.
- Existing languages fail to enforce linearity of assets, endangering the validity of a contract when assets get duplicated or deleted, accidentally or maliciously.

Thus, the paper advocates for using a type theoretic language called Nomos. To express and enforce the underlying contract, Session Type is used. Session type is used to moderate bidirectional communication between concurrent message passing process.

This paper could be read completely because of lack of time. Further, it was put to halt after switching to algo-dynamics task.

### 1.3.6 Suggested Improvement for Conference Website

The task was to suggest the improvement to the conference website. The website was examined and some minor changes to the navbar and replacing images grid with a Carousels. The suggestions to fallback to previous year website was suggested with accommodating for suggested improvement.

## 1.4 Additional Link

Work Log

Work Demo

## 1.5 Further Work

In the algo dynamic website we were able to design the standard architecture for building standard drawers. This could further be utilized to build standard architecture for other data structures:

- Stacks
- Queues
- Link-Lists

- Heap

The architecture that was designed for building the algo dynamics website, only have few features to maintain the interactive features. The ability to add multiple label should also be added. This could easily be extended, in our architecture without causing an architectural drift. It is also suggested that the code may need to be modified to work with the latest the latest version of Elm-Dagre.

## 1.6 Acknowledgement

I would like to thank Prof. Venkatesh Chopella. I would also like to thank our mentor Archit Goyal for guiding us throughout the internship and also my teammates Rohail Alam and Sivankar Pilligundla.

# Bibliography

- [1] Ankush Das, Stephanie Balzer, Jan Hoffmann, Frank Pfenning, and Ishani Santurkar. Resource-aware session types for digital contracts. *arXiv preprint arXiv:1902.06056*, 2019.