

# 2023 CSUSM Software Engineering Capstone Design Conference



California State University  
SAN MARCOS

## INTRODUCTION

**TARGEST** stands for Technical Abstraction Report Generator Extraction Software Tool.

- Our software application coordinates different documents and derives information from existing requirements documents.
- The software is specialized in reading Word documents with the Python/Docx library.
- Instantly generate multiple reports such as lists of all tags that have no children, lists of tags that have no parents, lists of tags that are not tested, lists of duplicate tags, and text reports showing parents adjacent to children.
- In addition, our software runs smoothly on both a Mac OS and Windows OS.
- We wanted something that is able to help companies with better handling of requirement specifications in the most accurate and safe manner that is compliant with FDA guidelines.

## QA REPORT

### Exploratory Data Analysis:

- What are the key requirements that need to be traced?

### Predictive Data Analysis:

- How can we predict and prevent requirement-related issues?

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.1)
```

```
model = LinearRegression()
```

```
model.fit(X_train, y_train)
```

```
# model's performance on the testing data using mean squared error
```

```
y_pred = model.predict(X_test)
```

```
mse = mean_squared_error(y_test, y_pred)
```

```
print("Mean squared error: ", mse)
```

Mean squared error: 0.086921945668132

- A mean squared error of 0.0869 is relatively small which is a good thing.

- The model's predictions are fairly accurate and it's performing well on the testing data.

Fold 1 mean squared error: 0.06

Fold 2 mean squared error: 0.10

Fold 3 mean squared error: 0.07

Fold 4 mean squared error: 0.04

Fold 5 mean squared error: 0.03

Average mean squared error: 0.06

- By cross-validation the model has a relatively low error rate on average across the different folds of the data.

- Results means that the model has performed well and is able to generalize to new data.

- Orphan Tags** need to be traced because they play the role of being tags that have no relationship to parent tags found in our dataset. These orphan tags are hypothetically considered as errors found in requirements that might have been added wrong.
- Childless Tags** need to be traced as well because they play the role of being tags that have no relationship to the child tags found in our dataset. These childless tags are hypothetically considered as errors found in requirements that might have been added wrong as well.

## ARCHITECTURE

The overall architecture of **TARGEST** follows a Model-View-Controller (MVC) pattern. This design method promotes loose coupling by separating the application into three interconnected components. Our Model represents the data and business logic of the application. The View displays data to the user and handles user interaction. In our Controller component, we have folders that serve a specific purpose for managing the flow of data between the Model and the View. The variables folder contains classes for managing variables in different formats such as Word and Excel. The parser folder contains classes for parsing trace tags and modifying trace information. The events folder contains classes for handling button actions and new instances of the application. The reports folder contains classes for generating reports in Word and Excel formats through iteration.

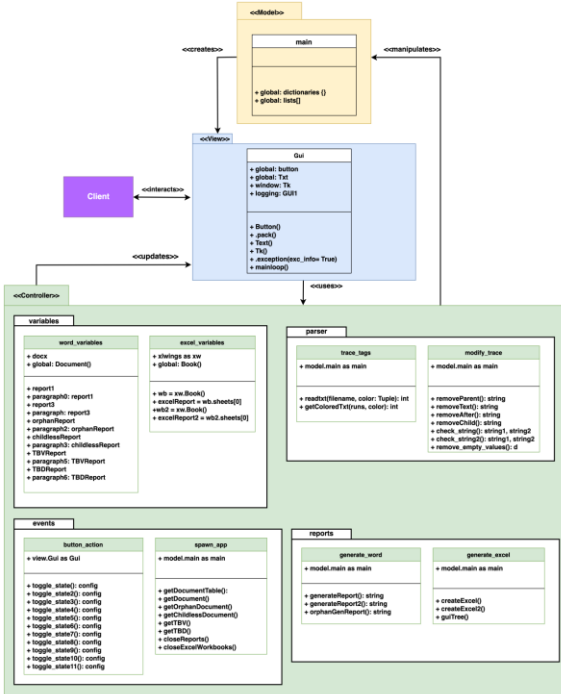


Figure 0: Architectural Design – Model-View-Controller

## AUTHORS & ABSTRACT

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**FACULTY ADVISER: ASIF IMRAN**

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**SPONSORED BY: TANDEM DIABETES CARE**

### ABSTRACT

**TARGEST** is an application that focuses on conducting requirements document management. The tool converts documents into a requirements document that can be used for code and testing purposes. It enables engineers to find misunderstandings and invent requirements to ensure smooth productivity. Additionally, it is used to demonstrate the accuracy of the documents and sufficiency of test coverage for itself. Many companies require this kind of software, so **TARGEST** provides a solution for that. The motivation behind this project was a partnership with Tandem Diabetes Care, a local medical and technical based company that develops medical technologies such as insulin pumps. They were looking for a requirement tracing software that would extract information from documents, review it before proceeding to doing the tasks. In addition, every change that Tandem makes in the insulin pump needs approval by FDA. **TARGEST** saves Tandem a week's worth of work and time by parsing data from any provided documents, performing a search of tag relation, then extracting tags and content. Once the extraction process has been completed, it regroups the selected information and reorganizes it in terms of the relationship between leading tags, trailing tags and orphan tags. Such traces are usually required by FDA & FAA and this process usually takes about a week's work to organize manually. Through this partnership, our team created **TARGEST**.

## RESULTS

Figure 1: Application Gui

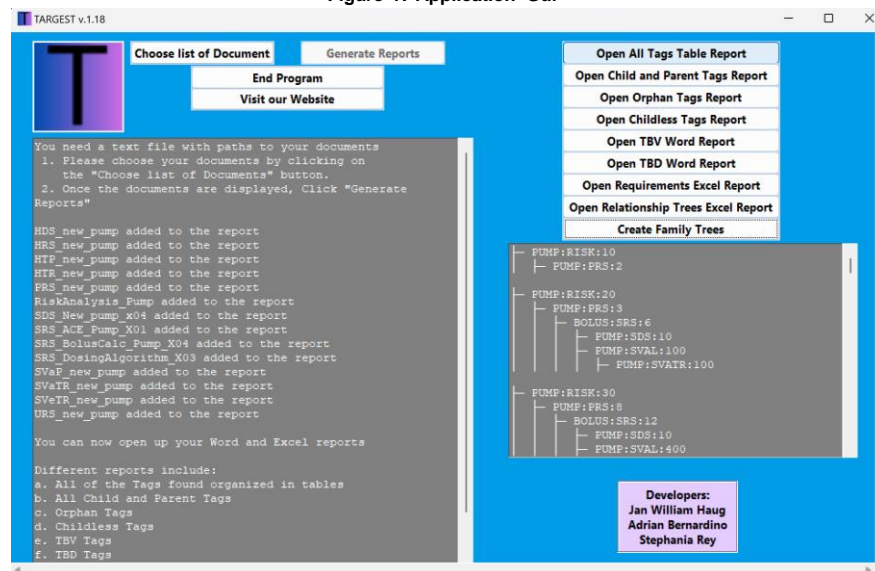


Figure 2: Diagram-Tree Generation Relationship Excel Report

1	Test Generation	Second Generation	Third Generation	Fourth Generation	Fifth Generation	Sixth Generation	Seventh Generation
2	PUMP-RISK-10	PUMP-RISK-20					
3	SEPARATOR						
4	PUMP-RISK-30						
5							
6							
7							
8							
9							
10							
11	SEPARATOR						
12	PUMP-RISK-30						
13							
14							
15							
16							
17							
18	SEPARATOR						
19	PUMP-RISK-40						
20							
21							
22							
23							
24							
25	SEPARATOR						
26	PUMP-RISK-50						
27							
28							
29							
30							
31							
32							
33							

Figure 3: All Tags and Requirement Tracing Report

All Tags and Requirement Tracing
[PUMP-RISK-100] The pump shall include a rechargeable Lithium Polymer Battery.
[PUMP-RISK-100] Details regarding the rechargeable Lithium Polymer Battery.
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