

MICHIGAN STATE

UNIVERSITY

Project Plan Presentation

General RATE Calculation Environment IDE

The Capstone Experience

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*From Students...
...to Professionals*

Functional Specifications

- Web-based editor for General Rate Calculation Environment (GRACE) language
- Helpful code features like code coloring and error highlighting
- Visual Studio Code plugin with same features for more complex development environments



Design Specifications

- Syntactic Highlighting
- Error Checking
- Code Navigation
- IntelliSense Completion
- Label Navigator

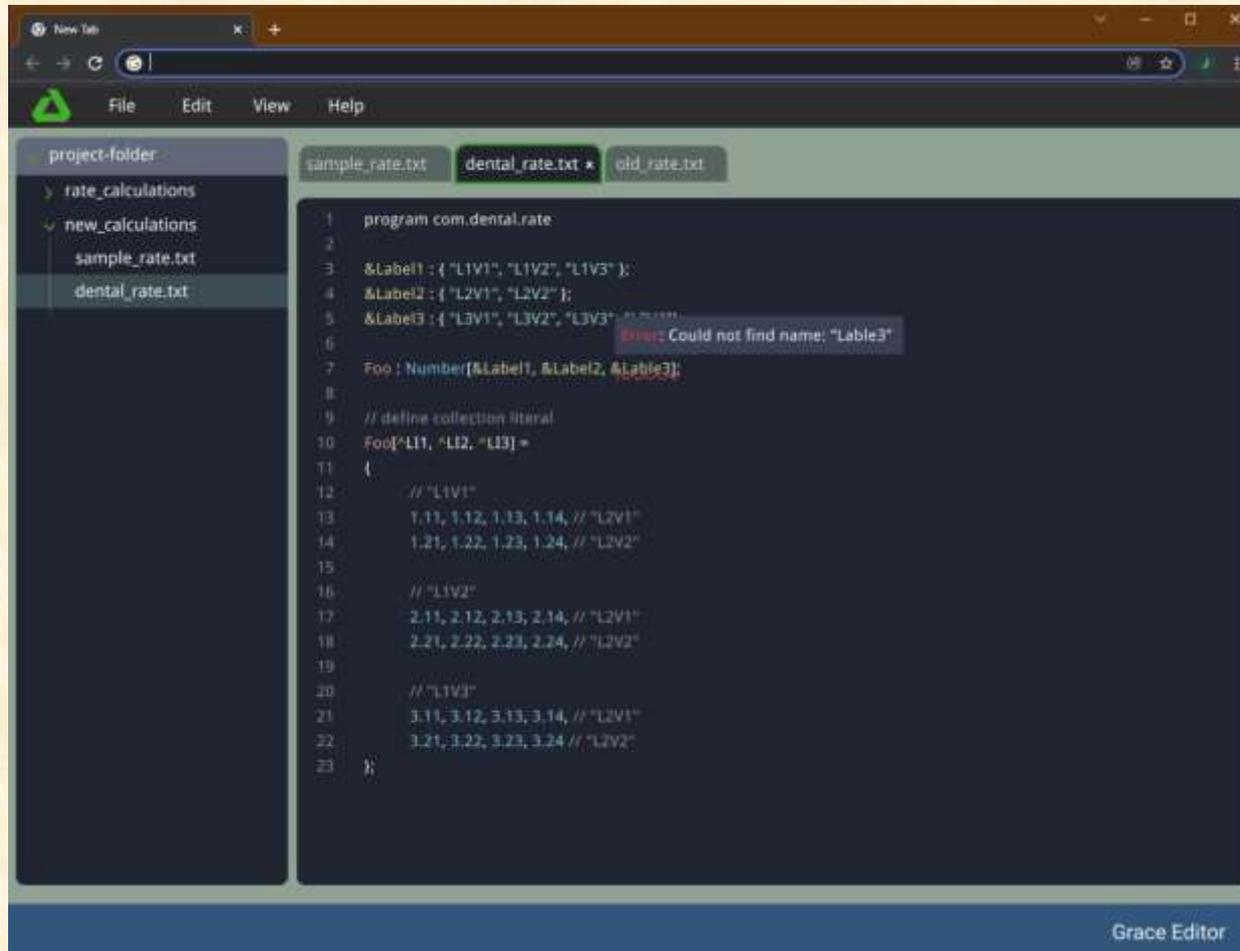


Screen Mockup: User Interface

```
1 program com.sample.rate;
2
3 // define our Labels
4 &Network : { "PPO", "Premier" };
5 &DentalProcedure : { "Cleaning", "X-ray", "Tooth Extraction", "Crown" };
6
7 // create Measurements by adding Label dependencies
8 BaseSeverity : Number[&Network, &DentalProcedure];
9 Utilization : Number[&DentalProcedure];
10
11 // add in Measurement values
12 BaseSeverity[ ^N, ^D ] = {
13 50.0, 55.0, 120.0, 1000.0,
14 60.0, 65.0, 140.0, 1200.0
15 };
16
17 Utilization[ ^D ] = { 1.58, 0.75, 0.11, 0.03 };
18
19 // create Severity Measurement using label iteration
20 Severity[ ^N, ^D ] = BaseSeverity[ ^N, ^D ] * Utilization[ ^D];
```



Screen Mockup: Syntactic Highlighting and Error Checking



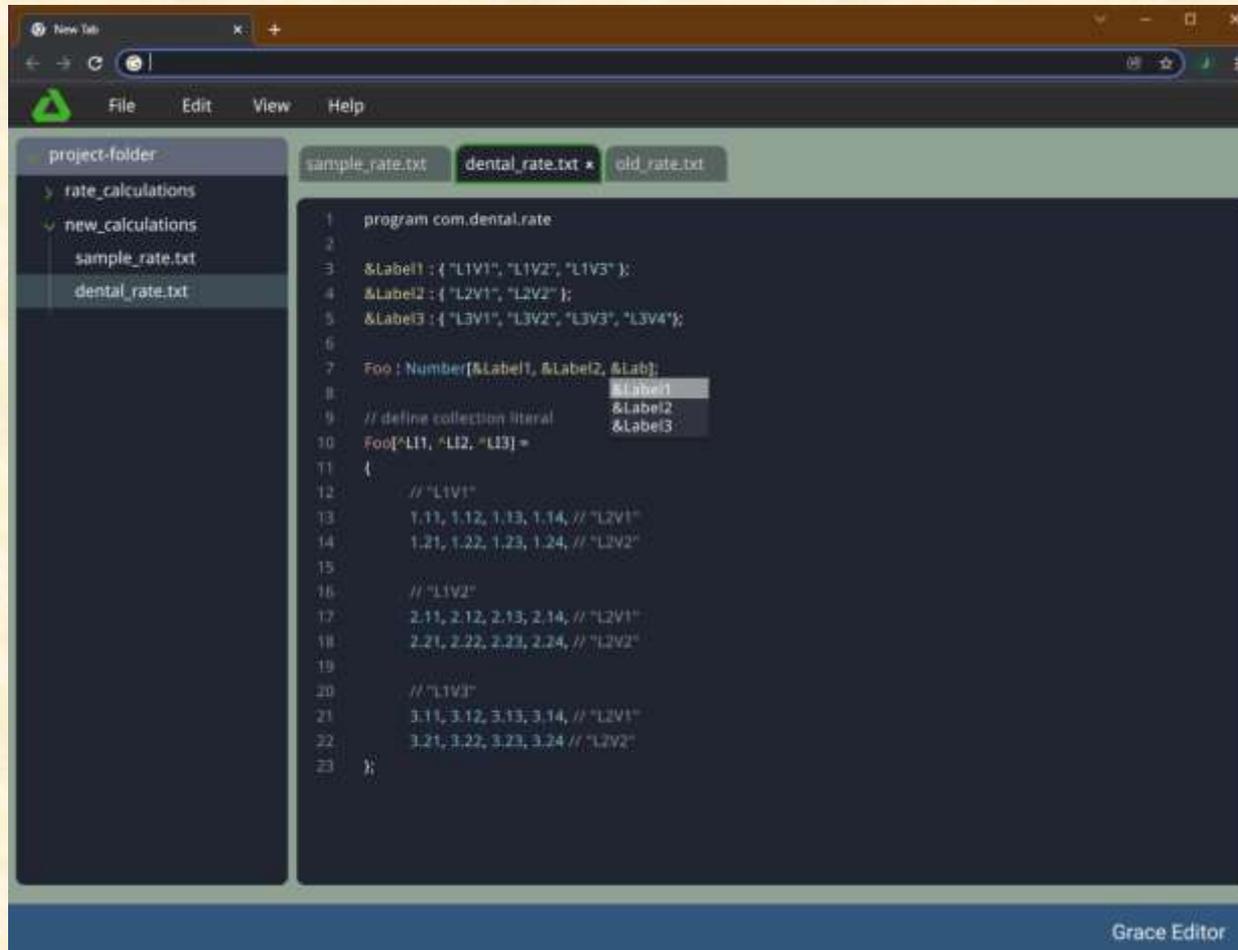
The screenshot displays the Grace Editor interface. On the left, a file explorer shows a project folder with subfolders 'rate_calculations' and 'new_calculations', and files 'sample_rate.txt' and 'dental_rate.txt'. The main editor window shows the code for 'dental_rate.txt' with the following content:

```
1 program com.dental.rate
2
3 &Label1 : { "L1V1", "L1V2", "L1V3" };
4 &Label2 : { "L2V1", "L2V2" };
5 &Label3 : { "L3V1", "L3V2", "L3V3", "L3V4" };
6
7 Foo : Number[&Label1, &Label2, &Label3];
8
9 // define collection literal
10 Foo["L11", "L12", "L13"] =
11 {
12     // "L1V1"
13     1.11, 1.12, 1.13, 1.14, // "L2V1"
14     1.21, 1.22, 1.23, 1.24, // "L2V2"
15
16     // "L1V2"
17     2.11, 2.12, 2.13, 2.14, // "L2V1"
18     2.21, 2.22, 2.23, 2.24, // "L2V2"
19
20     // "L1V3"
21     3.11, 3.12, 3.13, 3.14, // "L2V1"
22     3.21, 3.22, 3.23, 3.24 // "L2V2"
23 };
```

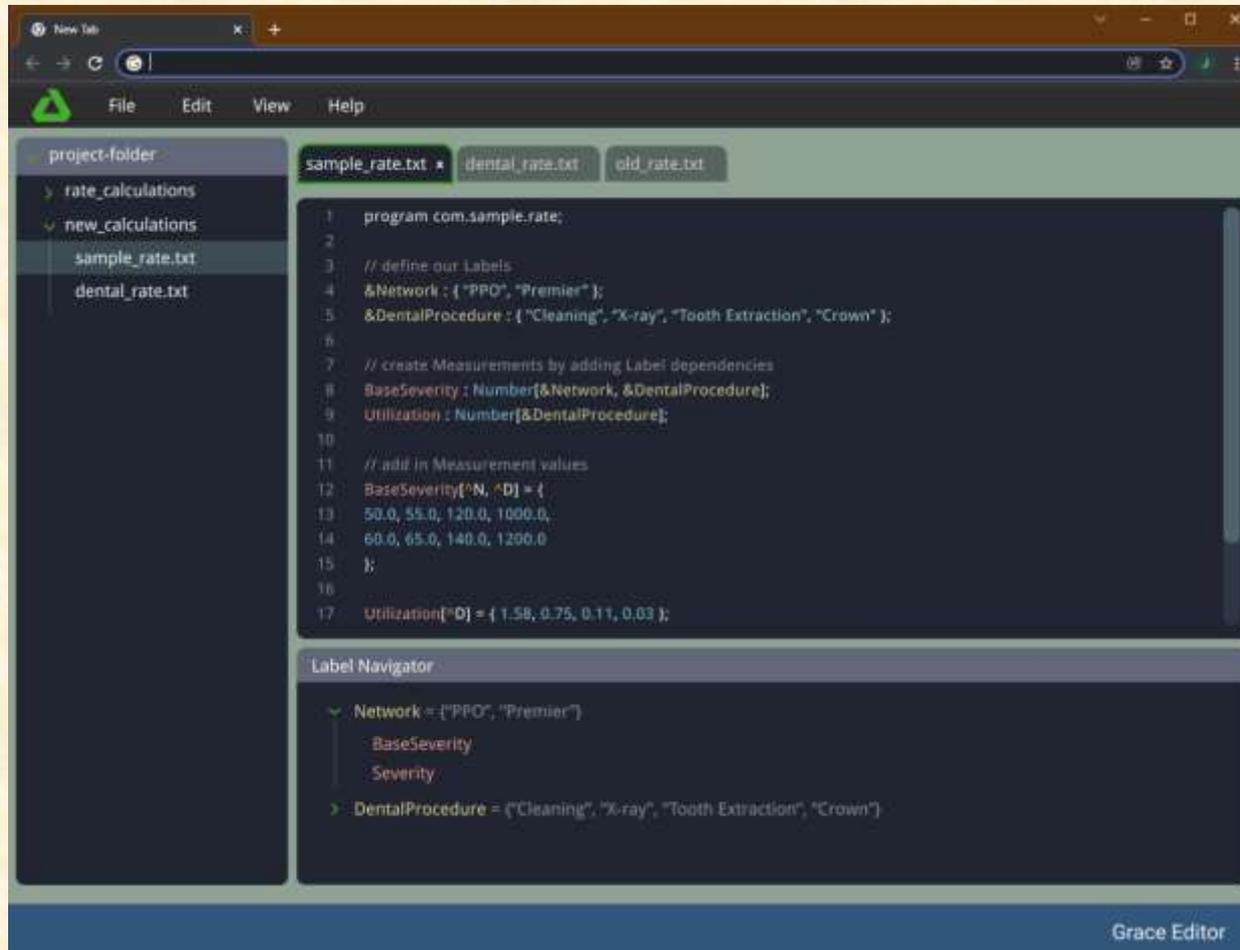
An error message is displayed on line 5: "Error: Could not find name: 'Lable3'". The code is syntactically highlighted, with labels in blue, numbers in red, and strings in green. The editor window title is 'dental_rate.txt' and the bottom status bar indicates 'Grace Editor'.



Screen Mockup: IntelliSense Completion



Screen Mockup: Label Navigator

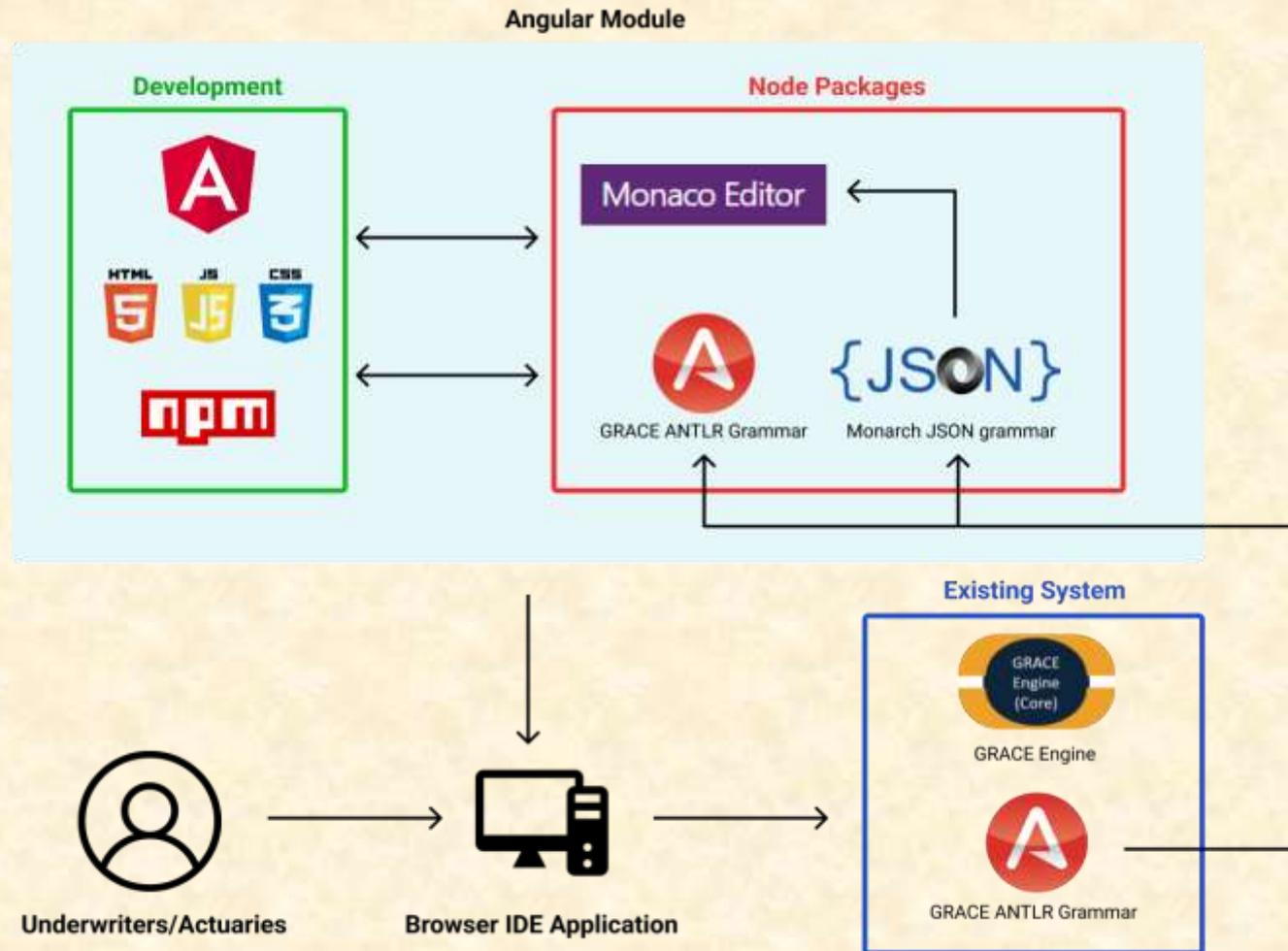


Technical Specifications

- Developed as an Angular Module using HTML/ CSS/ JS and managed by NPM.
- Monaco Editor API will provide custom the editor interface as well as language support for typical IDE features.
- ANTLR is a parser generator that will interpret code from within the Monaco Editor to provide error handling.



System Architecture



System Components

- Hardware Platforms
 - N/A
- Software Platforms / Technologies
 - Angular Web Application Framework.
 - ANTLR4 JavaScript Runtime Library.
 - Monaco Editor API.



Risks

- Integration of Different Systems
 - In the development of the project, we will use Angular, Monaco Editor, and ANTLR to develop this IDE. We need to make sure that these three systems can be combined into one.
 - We will divide core tasks for these three systems first, then we can consider how to merge them.
- Grammar-Derived Code Analysis
 - The language features are meant to be computed from the GRACE grammar so that changes to the language syntax can be immediately reflected in the language's tools.
 - We will incrementally upgrade the code analysis features. To establish the front-end experience, some of the components can be produced by hand. The first major step is to make tools with ANTLR to generate those hand-produced assets. Finally, the tools can be made to compute those assets at runtime in memory.
- Performant Code Analysis
 - The code analysis will be running client-side using the JavaScript build of the ANTLR engine. As a web application, GRACE IDE needs to be responsive which means the routines must be efficient while they continuously process new input.
 - ANTLR is already a well-designed system, so performance bottlenecks will be within our control. Incrementing on our abstract syntax tree handlers and testing on a variety of hardware and browsers will let us gauge and improve the overall performance impact of code analysis.



Questions?

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