

Code Visualization

Team Members

- Curtice Gough cgough2019@my.fit.edu
- Joshua Hartzfeld jhartzfeld2020@my.fit.edu
- Catherine DiResta cdiresta2019@my.fit.edu

Faculty Advisor

- Ryan Stansifer ryan@fit.edu

Client

- Ryan Stansifer Florida Institute of Technology

Client Meeting Dates

- 30 August 2023

Goal/Motivation

- The primary objective of this project is to achieve code visualization at a medium/high level (as opposed to algorithm visualization). Code tracing is often a complex task. Visualizing structures and the movement of data will aid users with debugging tasks while not spending too much time tracing execution by hand.

Approach

- Key features
 - Interactive GUI
This program will feature an interactive GUI. The GUI includes a display pane used for showing diagrams to represent various data structures. In addition to showing the data structures themselves, there will also be animations for demonstrating the movement of data.
 - Dynamic code analysis
Users will be able to step through source code during program execution line-by-line in a fashion reminiscent of popular debuggers such as GDB and x64dbg. This allows them to keep track of where they are in the program flow.
 - User intervention
The data structure visualization engine may occasionally make incorrect assumptions about which data structure is being represented. To solve this problem, we take inspiration from popular decompilers such as Binary Ninja and Ghidra to allow the user to rename/retype visual elements during analysis.

Novel Features

- Our cutting-edge code analysis system offers users a remarkable level of flexibility by enabling users to specify their data structure. This innovative feature empowers users to enhance the accuracy and effectiveness of the system according to their specific needs and preferences.

Technical Challenges

- Implementing a debugger will most likely involve either emulation or attaching to a process via an operating system tool such as ptrace. None of us have used those techniques before.
- We need to create a user-friendly GUI, but none of us know how to write GUI programs yet.
- Allowing a user to redefine the behavior of our visualizer will almost certainly prove to be a complicated task. Discovering how to accomplish this functionality while maintaining intuitive UI/UX design will be very challenging.

Milestone 1 (Oct 2): itemized tasks:

- Compare and select technical tools
 - GUI
 - Debugging
 - Programming language to use as the target of our visualization
- Provide small (“hello world”) demo(s) to evaluate tools
 - GUI,
 - Debugging
 - Target language
- Resolve technical challenges
 - Learn basics of emulation or ptrace
 - Learn basics of GUI development
 - Decide on plan for user intervention
- Compare and select collaboration tools
 - Software development
 - Documents/presentations
 - Communication
 - Task calendar
- Create requirement document
- Create design document
- Create test plan

Milestone 2 (Oct 30): itemized tasks:

- Implement groundwork for GUI application

- Test in various environments
 - GNOME
 - XFCE
 - KDE
 - Various aspect ratios
 - etc.
- Implement line-by-line debugger/tracer (CLI only for now)
 - Create test programs for debugging
 - Find what type of programs may cause issues

Milestone 3 (Nov 27): itemized tasks:

- Create first set of visual elements
 - Array
 - List
 - Tree
- Detect the three aforementioned data structures within target code

Task matrix for Milestone 1

Task	Curtice	Josh	Catherine
Compare and select technical tools	Emulation/virtual memory management	GUI	Target language
“hello world” demos	Custom debugger	GUI	Target language
Resolve technical challenges	Learn basics of emulation or ptrace	Learn basics of GUI	Decide on plan for user intervention (UI/UX)
Compare and select collaboration tools	Version control	Communication	Documents/Presentations
Requirement Document	33%	33%	33%
Design Document	33%	33%	33%
Test Plan	33%	33%	33%

I have discussed this with the team and approve this project plan. I will evaluate the progress and assign a grade for each of the three milestones.

Signature: _____ Date: _____