CprE 492 Bi-Weekly Report 03

2/21/2021 – 2/28/2021

Group #: 50

Project Title: Cy-Sec Game

Advisor: Manimaran Govindarasu

Front End Members: Jon Greazel, Hayden Sellars, Joseph Strobel

Back End Members: Harrison Majerus, Nicholas Battani, Stefan Peng

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Weekly Summary: Over the last week we've come closer to a working application. Our front end to back end communication is almost finished, our front end is mostly functional, and our back end analysis engines are ready for testing.

Past 2 Weeks Accomplishments:
- Jon:
    - Created a new inspector: Each node needed an impact as well as a probability out of 10 of occurrence so this new inspector allowed for assignment of these values. We also decided on adding a SafePath node so this node will have a probability field, but not an impact. This will need slight modification next week.
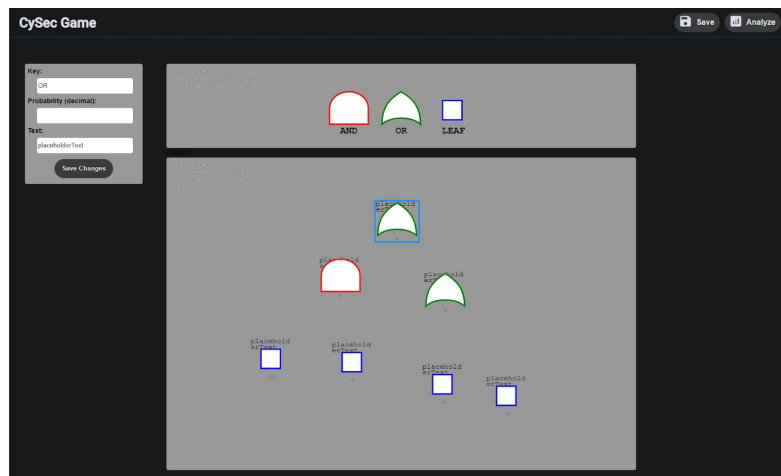
- Hayden:
    - Worked on Inspector component; css style changes and refactoring some of the existing code.

- ○ Animations through go.js library
- Joe:
  - ○ Continued research into updating the tree when uploading the json file. The tree updates incorrectly, so I merged the branch and we will revisit this later. Additionally, I completed the ticket to add tree validation logic on the frontend to validate before sending a request to the backend.
- Harry:
  - ○ Worked on implementing and testing the attack tree algorithm with new features/requirements brought up in weekly meetings. Researched for a better understanding of game theory and practical application of nash-equilibrium to our attack-defense tree engine.
- Nick:
  - ○ Worked on connecting the API with backend functions to provide full usability for the application.
- Stefan:
  - ○ Worked on implementing prototype attack-defense tree analysis engine. This extends the current attack-tree prototype to include the ability for defense nodes to be added. Currently, the attack and defense scenarios can be calculated. Game theory analysis will be added next week.
  - ○ Sample output showing attack and defense scenarios:

```
risk: 3.233     prob: 0.0101    impact: 320.0    : LEAF LEAF3
risk: 0.52      prob: 0.0048    impact: 109.0    : LEAF LEAF4
risk: 18.446    prob: 0.0762    impact: 242.0    : LEAF2 LEAF3
risk: 1.116     prob: 0.036     impact: 31.0     : LEAF2 LEAF4
risk: 9.1       prob: 1.0       impact: 9.1      : DEFENSE1 DEFENSE2
risk: 9.0       prob: 1.0       impact: 9.0      : DEFENSE3 DEFENSE4
```

Pending Issues: As our application gets closer to its early stages of a viable product we are unsure of how well our designs will translate to real world uses. Our advisor, Manimaran, has proposed having his students use our app for a small homework assignment as part of some beta user testing.

Individual Contributions:

Team Member	Contribution	Weekly Hours	Total Hours
Jon Greazel	Creating a new inspector and safe node	6	19
Hayden Sellars	Refactoring front-end code, inspector, animations	6	18

Joe Strobel	Researching diagram update, tree validation logic	6	19
Harry Majerus	Attack tree algorithm	6	19
Nicholas Battani	API work	6	18
Stefan Peng	Attack-defense tree algorithm	6	18

Plans for the Upcoming 2 Weeks:
- Jon:
  - I plan to modify the inspector I created last week to change impact per node to cost of infiltration and give the root node an impact. Afterwards I may move to adding tooltips on fields to inform the user about what data they're filling out.
- Hayden:
  - Animations
- Joe:
  - I plan to add more validation logic for the addition of a defense node. Add the defense node.
- Harry:
  - Finish attack tree algorithm with new features. Document how our algorithms work for future explanation. Help with attack-defense analysis.
- Nick:
  - Finish connecting API to attack-tree functions, begin connections for attack-defense tree engine.
- Stefan:
  - Implement game theory analysis for attack-defense tree engine. This will analyze the possible scenarios for the attacker and defender and output the optimal strategy for each player by computing the Nash equilibrium.

Summary of Weekly Advisor Meetings: During our weekly meeting with Manimaran we discussed our analysis function for attack trees and made some small modifications to that. We also discussed moving forward to attack-defense trees and what changes need to be made for that analysis method. He also proposed using our software as part of a small homework assignment for one of his cybersecurity classes he's teaching.