Team 23: Hardware Warriors.

New Mexico SuperComputing Challenge .

Final Report

06 April 2022

Team Number: 23

School Name: Justice Code International

Team Members: Mekhi Bradford, Kingesly Walker, Wellbeing Ogunsanwo, Hero Okhaifo

Sponsor: Caia Brown, Becky Campbell, Ryan Palmer

Project Mentors: Caia Brown, Mary Sagartz

Maze Solving for Beginners

Executive Summary

Introduction

We all enjoy sitting around and playing brain games from time to time. Games like Sudoku, crossword puzzles, and concentration can give us the mental breaks that we need. One of the most popular brain games is the maze. A maze can be defined as a network of paths designed as a puzzle in which one must find a way, typically from an entrance to a goal. There are two types of mazes which are multicursal and unicursal. Multicursal mazes refer to those that contain multiple paths to the center and the outside through which the solver must find a route. Unicursal mazes, also referred to as labyrinths, are those that will contain a non-branching singular path which will ultimately lead to the center. The term "labyrinth" is generally

synonymous with "maze", but can also imply specifically a unicursal pattern. The pathways and walls in a maze are typically fixed, but puzzles in which the walls and paths can change during the game are also categorized as mazes or tour puzzles.

Problem Statement

Maze solving is the act of finding a route through the maze from the start to finish. There are several methods that can be used to solve mazes. Certain methods are designed to be used inside the maze by a traveler with no prior knowledge of the maze. Others are designed to be used by a person or computer program that can see the whole maze at once. Each methodology can be used on different types of mazes, but there is no guarantee that they will work. In this project, we seek to use Starlogo Nova to create a maze solving algorithm that is able to combine multiple maze solving methodologies to solve any maze or labyrinth encountered.

Computational Model

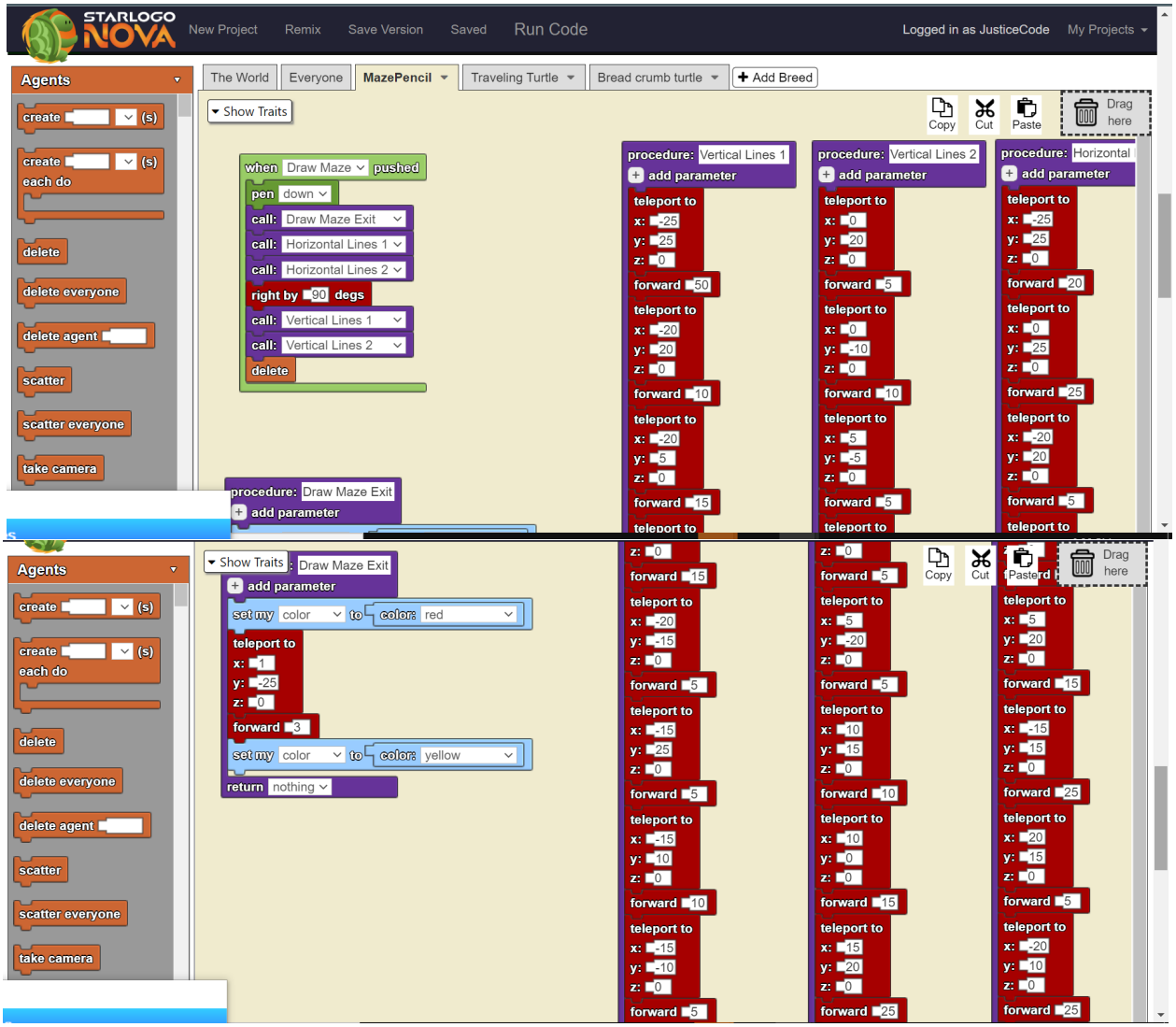
- Selection - Methods evaluated were the Wall Follower Method; the Trémaux Method; and the Bread Crumb. We determined that a Wall Follower algorithm would be best suited for our project.
- Modification - We were able to meet with somebody who had worked on maze codes in the past and were able to get inspiration from his code to use in ours.
- Visualization - This maze we selected is a decent sized maze and didn’t really expect too much.

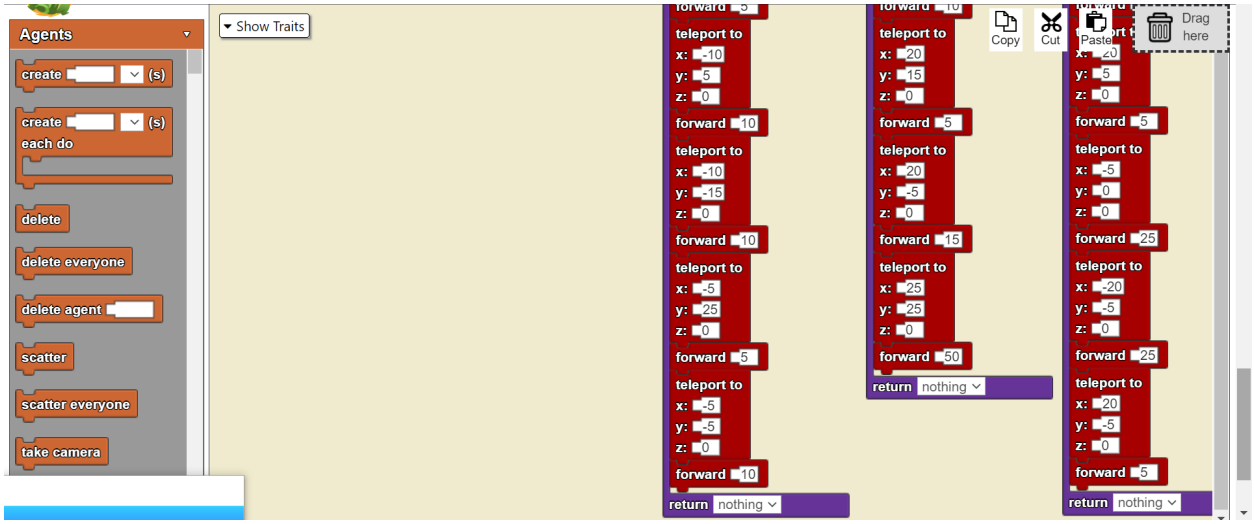
- Limitations - Some of the limitations we were expecting was for turtles to complete the maze without using any arrow keys, or a keybind to move the turtle..

Problem Solving : The Finished Maze Search Program

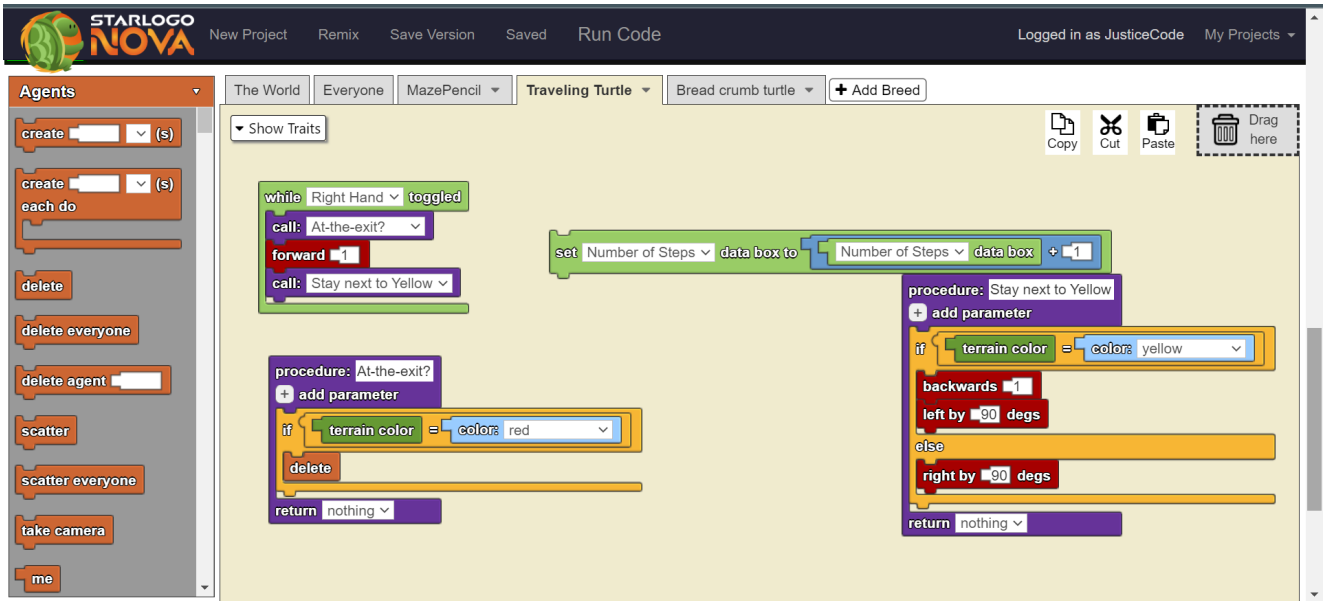
To make it easier for us we assumed that our maze was divided up into “squares.” Each square of the maze was either open or occupied by a section of wall. The turtle could only pass through the open squares of the maze. If the turtle bumped into a wall it must try a different direction. The turtle would need to require a systematic procedure to find its way out of the maze

Starlogo Nova - Maze Pencil coding

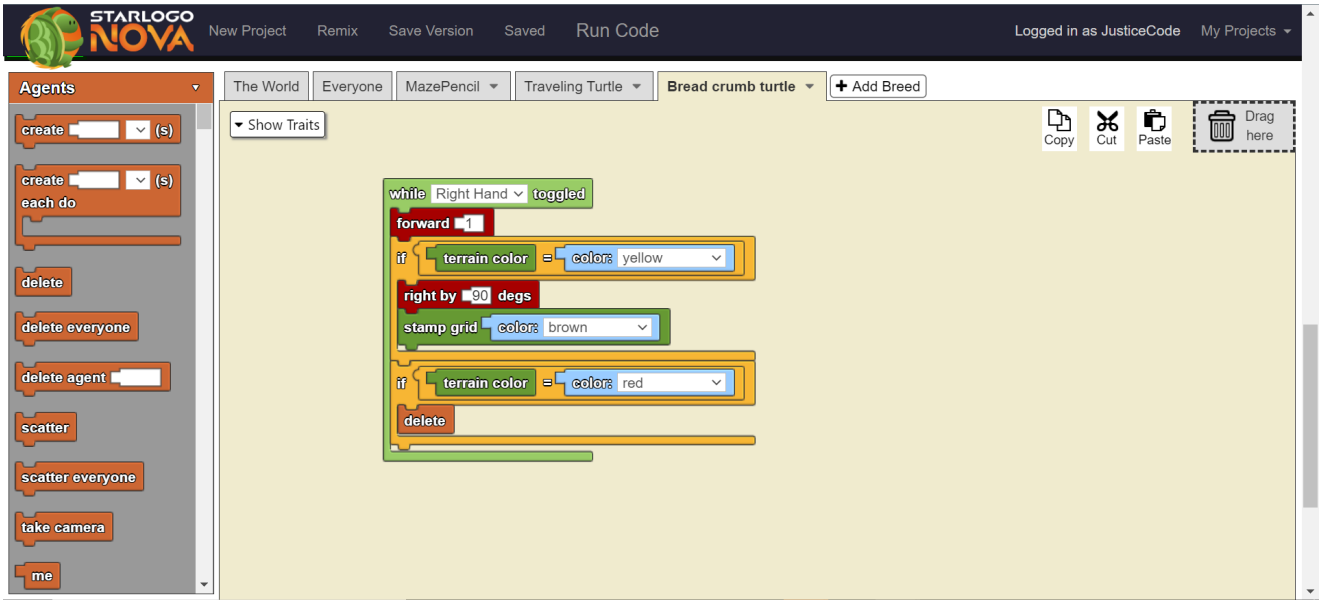




Starlogo Nova - Traveling Turtle coding



Starlogo Nova - Breadcrumb Turtle coding



Conclusions

Results - The algorithm performed as expected. The turtles were able to successfully navigate the maze.

Future Work - Our future work is to implement the algorithm on a much larger maze which requires more complex coding. We will most likely use a five-by-five maze. We are excited to make people who do not understand mazes more able to solve them.

Acknowledgements

Caia Brown

Rebecca Campbell

Mary Sagartz

Ryan Palmer

Starlogo Nova

References

"Adaptive Behavior for Prisoner Dilemma Strategies Based on Automata with Multiplicities," Available at: Http://Citeseerx.ist.psu.edu/Viewdoc/Download?Doi=10.1.1.10.3740&Rep=rep1&Type=PDF, Last Visited." *CiteSeerX*, https://citeseer.ist.psu.edu/showciting?cid=5816877.

Bennett, Brian. "Why Your Roomba Takes a Weird Path to Keep Your Floors Clean." *CNET*, CNET, 27 Aug. 2021, https://www.cnet.com/home/kitchen-and-household/this-is-why-your-roombas-random-patterns-actually-make-perfect-sense/.

How Does a Roomba Work? (Animation) | the Zebra. https://www.thezebra.com/resources/home/how-roomba-works/.

ManualsFile. *Download User Manual Eufy Robovac 25C Robot Vacuum*, https://manualsfile.com/download/rsczno5hj.html.

"Maze-Solving Algorithm." *Wikipedia*, Wikimedia Foundation, 10 Jan. 2022, https://en.wikipedia.org/wiki/Maze-solving_algorithm.

Ruth Dalton Professor of Building Usability and Visualization, and Nick Dalton Lecturer. "How to Escape a Maze – According to Maths." *The Conversation*, 20 Jan. 2022, https://theconversation.com/how-to-escape-a-maze-according-to-maths-71582.