

Lee Clayberg

Internship Essay

May 25, 2018

Masconomet Route Finder Program

Every time a parent comes into the school for Parent-Teacher conferences or a new student comes to Masconomet they may not have any idea where the location of a classroom is in the school. They may need to use a restroom or exit the school for a fire, and not know where to go. The focus of my internship is to help these people who need direction when navigating the school.

For my internship, I made a route finder program for Masconomet High School. The program uses a three-dimensional model of the school with over 300 points to figure out the shortest path from one room to another, or from a room to either a bathroom or fire exit. With five different controls, the user can rotate around the school. The program also allows the user to make floors disappear in order to see the ones below, or with one click of a button, they can look straight through walls to the hallways inside.

For one of my computer science independent studies I was working with many algorithms including Dijkstra's Algorithm. This algorithm takes a graph of points and calculates the shortest path between two of them. The algorithm works by first setting all the point values to infinity. Then it recursively loops through all connected points, starting from the end point and setting the value of the point to the distance between. The algorithm will do this until all the points have a value with the shortest distance. Then, the algorithm will recursively trace back the shortest path from the start point by picking the connected point with the lowest number until it

reaches the end point. In some instances, I had to loop from multiple endpoints such as the restrooms and fire exits to find the closest one. This algorithm was really interesting to me, so having the opportunity to apply what I learned this past year seemed like something that would make a good internship.

I started my internship with using a floor plan from the front office to make the three floors of the high school with a three-dimensional game engine called Unity. I first added cubes for all the walls and added cubes underneath to act as the floors. Then I stacked the floors on top of each other to start forming the school. Now that I had the basics, I could start making it look like the school. I started with the brick around the first two floors and put the white material on the third floor. I added the front windows, doors and the covering over the front doors. I then worked my way around the school adding the windows and doors to the rest of the building. I added all the windows in the courtyard including the rounded library windows. Then, I added the rounded roofs for each stairwell and added the windows below. Next, the smaller details were added to the outside including the bands of grey brick and roof objects. Now the outside was practically done, and I turned my focus on the inside of the building. I added all the stairs inside each of the towers and placed all the doors and wood paneling. Now the model of the school was complete.

The next major step in the project was to make the Dijkstra Algorithm work in the school. I started collecting data points on each floor for every classroom door and change of direction either in the hallway or in the stairwells and added all of them to a spreadsheet. The total amount of points I collected was over 300 so I could be as accurate as possible. Now that I had all the x,y,z coordinates for the points, I had to add a reference to all the neighboring points.

Once all that had been completed, I tested out the routing between points and it worked beautifully.

The final step in the project was to make a nice user interface. I needed buttons for running the algorithm, turning the three dimensional model, and picking the beginning and ending rooms for the route I wanted to take within the school. I started with the three option buttons for the bathrooms, the fire exits, and finding the route between classrooms. The between classroom option was the easiest because all that had to be entered is the two classrooms. The bathrooms and fire exits have to loop through all the locations in the school and check which one is the closest. There also needed to be a button to switch between girl and boy bathrooms. I added two dropdown lists for the rooms, and a button for running the actual program. For the user to look around the school, I added a toggle to turn on panning, and sliders for zooming and tilt the camera. I also added a slider for removing floors to see inside. The last toggle that I added gives the ability to see inside the building through the walls. I also added instructions at the beginning of the program so the user can understand all of the controls.

The biggest difficulty in making the program was trying to make the three dimensional model as close to the school as possible. Also, it was challenging figuring out how to make the program output the shortest path to the nearest bathroom or exit instead of just finding the shortest path. The extra step of finding the nearest bathroom before running the algorithm required a lot more time and attempting different solutions. Something that I hadn't done before, and something that I learned during this project, was how to make moving textures and scaling them to the objects size. This is seen in the path where the arrows are constantly moving and the arrows are all the same size, even though they are on different sized objects.

This project has definitely enhanced my love for computer science, and I plan to use the skills I have learned in this project for other projects in the future. I have learned many new ways to use the features in Unity, and I believe this project has increased my overall ability to code in general. I knew at the beginning of the project that it was going to be a challenge, and I'm glad that I had the courage to take on this demanding task. I had a prior knowledge of using Unity in computer science class and at home, so I didn't think I was going to learn as much as I did throughout the project. During the project, whenever I came up with a new feature I could add to the program, it usually involved researching how I might implement it and trying over and over until it worked. Every time I needed an image in the program, I drew them up in Flash then imported them into unity to be used. Every image excluding the unity logo was drawn-up by me. This project is a great addition to my computer science portfolio and I can use it as example of my hard work. Hopefully the school could use this in the future for students and parents.

This project enforced the fact that I want to go into the field of computer science in the future. I realized throughout the project that if you want to accomplish something, you have to keep trying until you do. I think that is one of the biggest components of computer science in general. This mind set can be apply to anything in life not just computer science.

This internship revolves around one of the most important aspects of computer science, Algorithms. I wanted to already be familiar with algorithms like the Dijkstra Algorithm, when I go to college next year for computer science I'll already have some background with them. I really enjoy making games and programs, so this internship allowed me to show what I can do when it comes to computers. Throughout college I want to continue to write programs even if they aren't for an assignment. Computer science allows me to let my mind run free and I have

the ability to make whatever I want with whatever purpose. There are no limitations when it comes to computer science, which is why it is an ever growing industry.

My goals for the future is to pursue computer science through college and eventually get my masters. Computer science is very similar to art when it comes job finding. You need a solid portfolio of past programs you have made to show to employers. This internship project makes a great addition because of its strong roots to algorithms. This internship didn't change my mind when it comes to what I want to study. This project made me want continue on my path in computer science. The biggest take-away from this project is the skills I learned in Unity. I can use these skills to make games and other programs in the future.

Works Cited

“(4) Route-Finding (article) | Algorithms.” *Khan Academy*,

<https://www.khanacademy.org/computing/computer-science>. Accessed 24 May 2018.

“Dijkstra’s Algorithm.” *Wikipedia*, 19 May 2018. *Wikipedia*,

https://en.wikipedia.org/w/index.php?title=Dijkstra%27s_algorithm&oldid=842039768.

JesseEtzler. *Unity Tutorial #2 [Scrolling Textures][Free Script Included]*. *YouTube*,

<https://www.youtube.com/watch?v=NvxJpL6koPM&t=1s>.

Look through Objects - Asset Store.

<https://assetstore.unity.com/packages/tools/utilities/look-through-objects-47755>. Accessed
24 May 2018.

Masconomet School District / Homepage. <http://www.masconomet.org/default.aspx?PageID=1>.

Accessed 24 May 2018.

Sloan Kelly. *Unity 5 UI Tutorial - Slider Control*. *YouTube*,

<https://www.youtube.com/watch?v=24J1HG7IzS0&t=98s>.

ZeuxWarrior. *Unity 4.6 Advanced UI Elements - Drop Down Menus*. *YouTube*,

<https://www.youtube.com/watch?v=rgGi9o9LCUI>.