# Minecraft Maze

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Abstract

The purpose of this report was thoroughly describe the game created to be showcased at the Boston Children's Museum on Apr 22, 2022, assigned by professor Joshua Hertz at Northeastern University for Cornerstone of Engineering Spring. Our class decided to use a video game theme, and our group based our game on the very popular Minecraft. Our game had to be fun, easy to understand, and safe for children to play. We decided to make a maze Minecraft game, in which the goal was to collect food and give it to different animals to befriend them. We had a $100 budget and 2 months to complete this project. We used ¾ inch wood for the main construction of the build, utilizing a multi layer construction to separate where the player moved and where the wires would go. This would also keep the player token from falling out of the board. As our prize for the children we gave out laser cut Minecraft Steve (a character from Minecraft) heads. While we ran into problems with the electronics of our project the children still seemed to enjoy playing our game.

Introduction to the Problem

We must create a coordinated experience to present at the boston children's museum. Joshua Hertz made an agreement with the Boston Children's Museum, that his students (us) will create an experience for the children (ages 4-8) that attend the museum on April 22. The event will last for 2 hours, and should be interactive and fun for the children. It should also be safe, consider the parents' expirience, and follow the rules of the museum. Each of Professor Hertz's sections has one E-board which picks the theme of the projects for that section to create a cohesive expirience. Our section's E-board picked a video game theme. Each group's project must be: physical (not strictly digital), incorporating arduino, under $100, and have a prize token to give to the children when they complete the game (task). The game should be original compated to other projects. Each group has 2 months to complete their project and has access to Northeastern University's First Year Engineering Learning & Innovation Center's tools and resources.

The experience should be enjoyable for the children who visit the Boston Children's Museum on April 22. The game should take between two and five minutes for one child to complete.

Design Choices

Our group chose to base our game off of elements from Minecraft. This worked well with the game mechanics we wanted to implement. It is an extremely popular game known by people of all ages. Minecraft is an open-world sandbox video game that allows players lots of freedom in how to play the game.

Our game was single-player, where a player moves a game token around a maze-like board. The player's goal was to collect a food item and find the specific animal said food is associated with, as shown on diagrams (figure 1) attached to the sides of the game board. A simple pictures were used in case the children couldn't read, or would be put-off by an explicit listing of the game rules.

Table 1 Shows the animals we choose to include and the food items they correlate to.

The game board also follows the Minecraft theme by having different biomes on the board. Plains, mountains, ocean, and forest were included, each as a quadrant on the board. The maze was somewhat intricate enough for the children to understand where they should move their game token.

**Figure 1** shows the diagrams to show the kids what item corresponds to each animal.

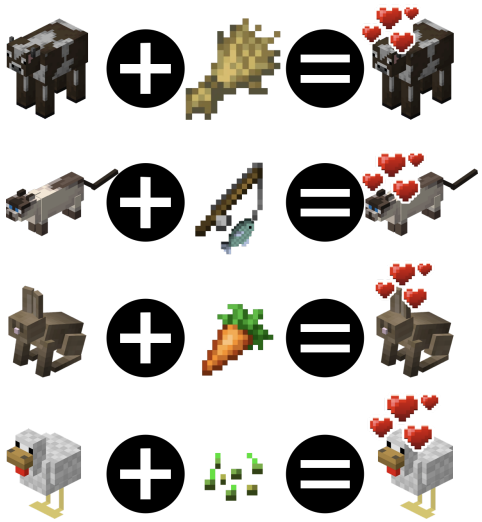


**Table 1** shows each of the four biomes and each animal-food items pair.

| Biome | Animal | Food |
|---|---|---|
| Forest | Cats | Fish |
| | Rabbit | carrot |
| Plains | Cow | Wheat |
| | Chicken | Seed |
| Ocean | Turtles | Sea Grass |
| Mountain | Llamas | Hay Bales |

## Physical Construction

The game board used ¾ inch wood, and had a 24 inch by 24 inch footprint. We had wood from a previous project, so it was used for this to save costs. Our budget was $100, and wood took the largest proportion of the costs. The game board was planned using a spreadsheet (figure 2). Each square represented 1 inch by 1 inch. The design also has the locations for the food items and the animals. We used the tools found at FYELIC (First Year Engineering Learning & Innovation Center) to cut, and build the game board.

An important game mechanic was how the player token slid through the board. As shown in figure 3, a sandwich design was used to ensure that the game token couldn't exit the board, and could slide freely. Also shown was how arduino was incorporated. When the token reaches a food or animal location, it will complete the circuit between 5V and ground using the metal brushes on the bottom of the token and the arduino will interpret that data.

**Figure 2** shows the map design. Each square is 1 inch by 1 inch. Item locations are red. Animal locations are blue. The green “START” square represents a space where the token may be removed from the board.

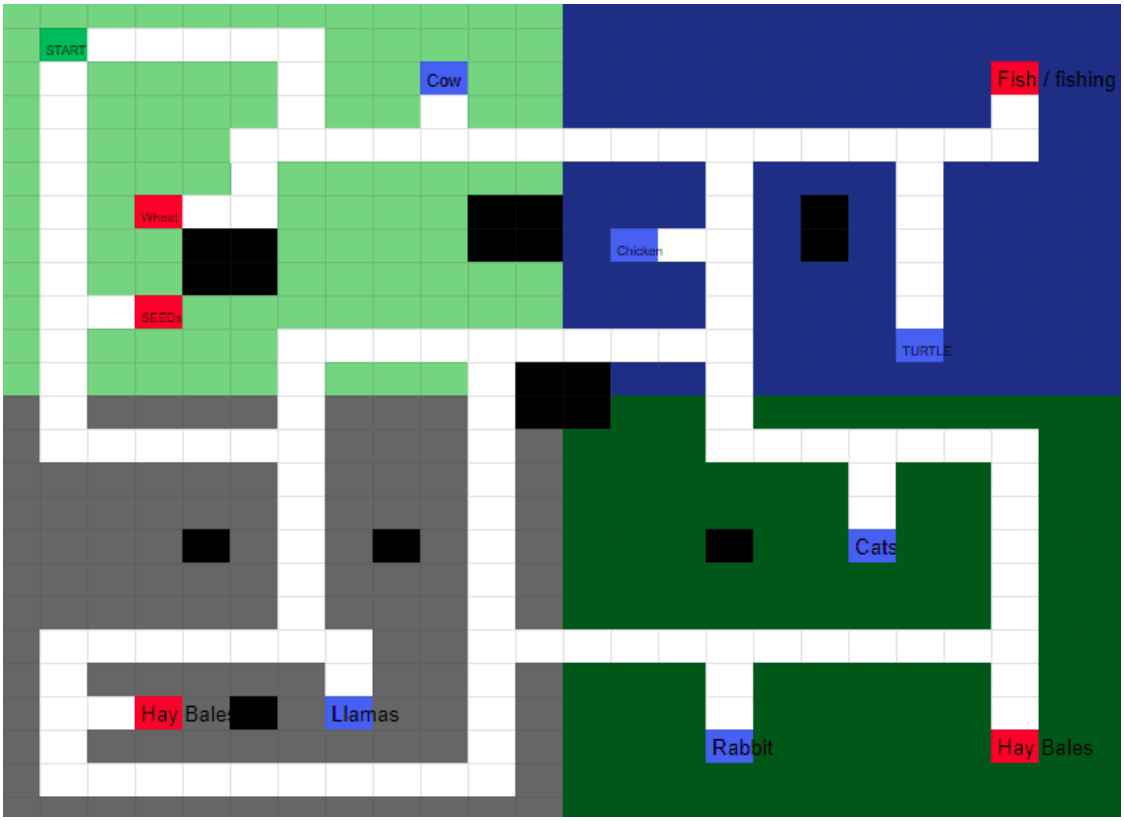
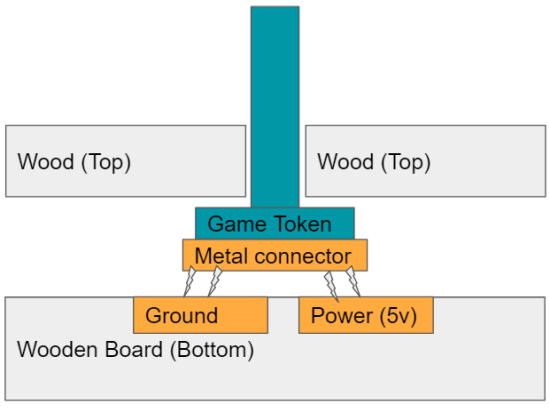
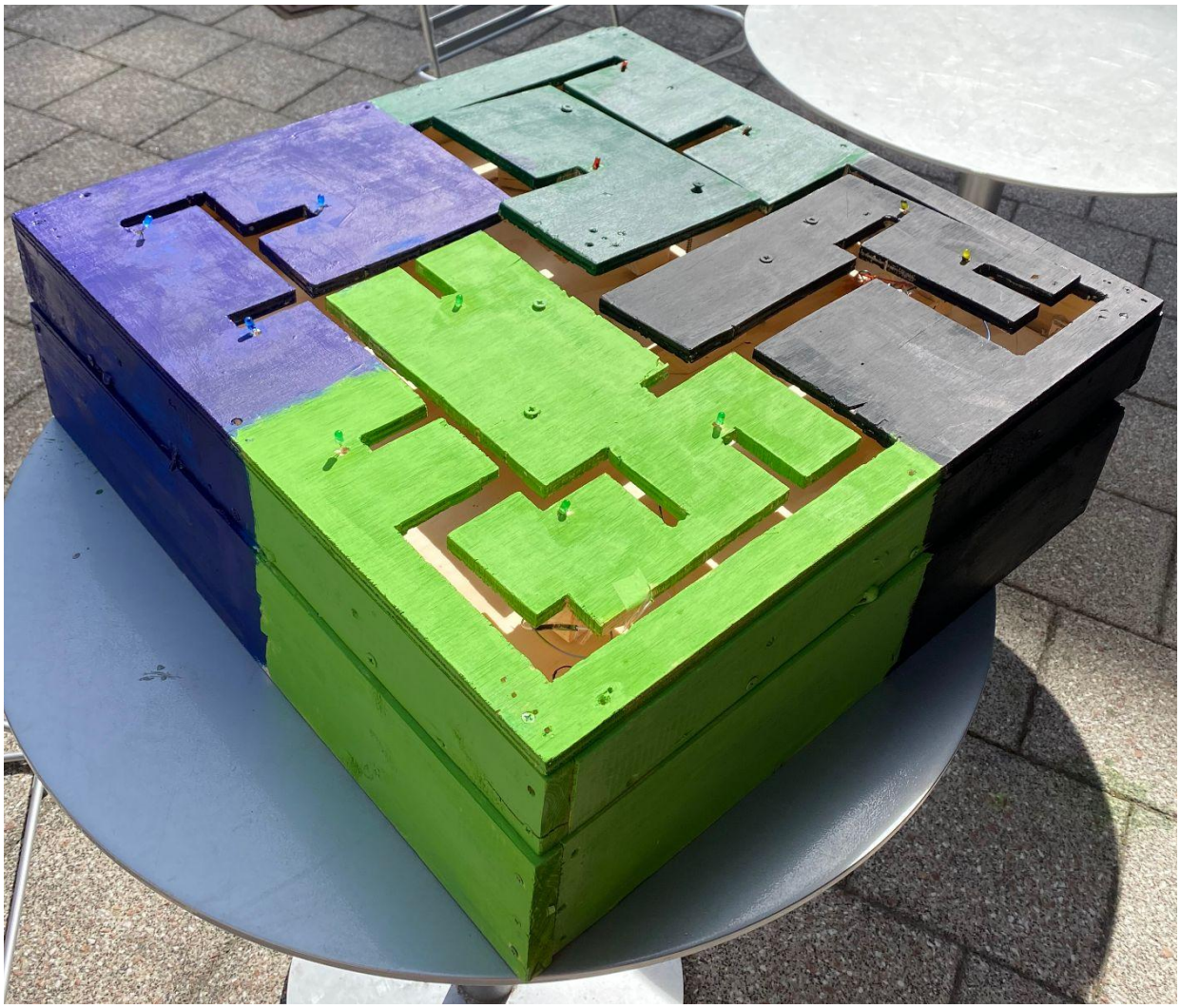



**Figure 3** shows how the game token stayed fixed to board, how the game token may complete the arduino’s circuit and send a signal to the arduino



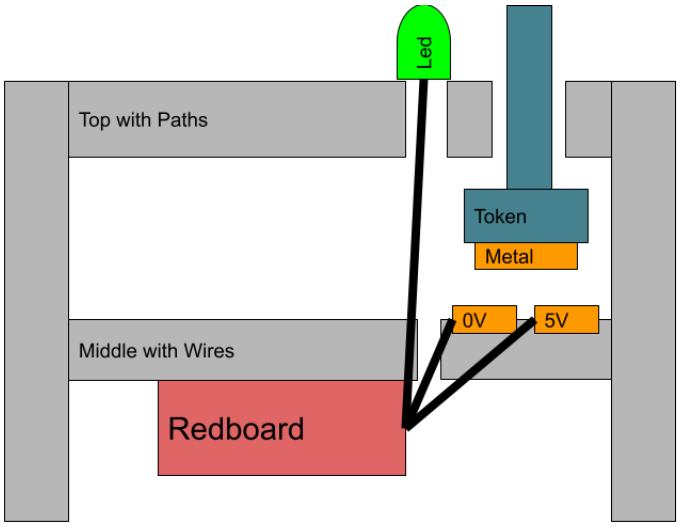
The final construction of our game board was more difficult than anticipated. Problems included difficulty cutting the path of the game token, and trouble with supports holding up the inner top pieces that weren't connected to the board's perimeter. Figure 4 shows the final construction of our game board.

**Figure 4.** Final Construction of Game Board



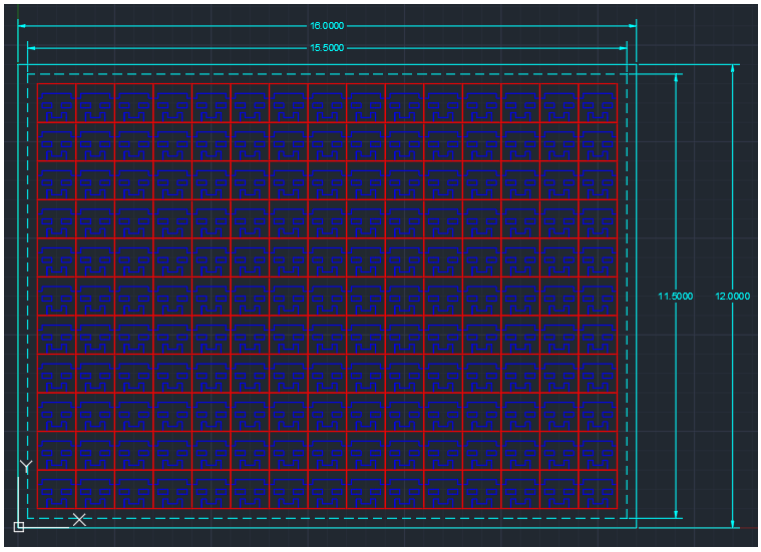
Multiple layers of wood were used to separate the Redboard and the player token. This made sure that wires were not pulled by the game token. Figure 5 shows a cross section of the game board, and how the wiring connects to the redboard.

**Figure 5.** This shows the different compartments within the game board




The prize was a laser cut 1 inch by 1 inch Minecraft steve head. Since Steve was the character users play as in Minecraft, it was a recognizable connection to minecraft. Laser cutting worked well, and was very cost and time efficient.

**Figure 6.** Prize modeled on AutoCAD



## Code

Due to the large number of independently functioning components that were necessary for the game, more than one redboard was required to have enough pins. As such, it was necessary for the redboards to communicate. See figure 7 for an outline of how the code worked.

To have the reboards communicate, the wire.h library was used. This allowed for one redboard to send packets of information to another. This was utilized by having all of the input buttons connected to the controller redboard, the one that sends information, and all of the logic and LED's connected to the follower redboard. All buttons on the board, food or animal, were assigned a button and a number. Depending on which button was pressed, an associated integer would be sent from the controller to the follower redboard, which then allowed the follower to interpret where the game piece was and appropriately turn LEDs on or off.

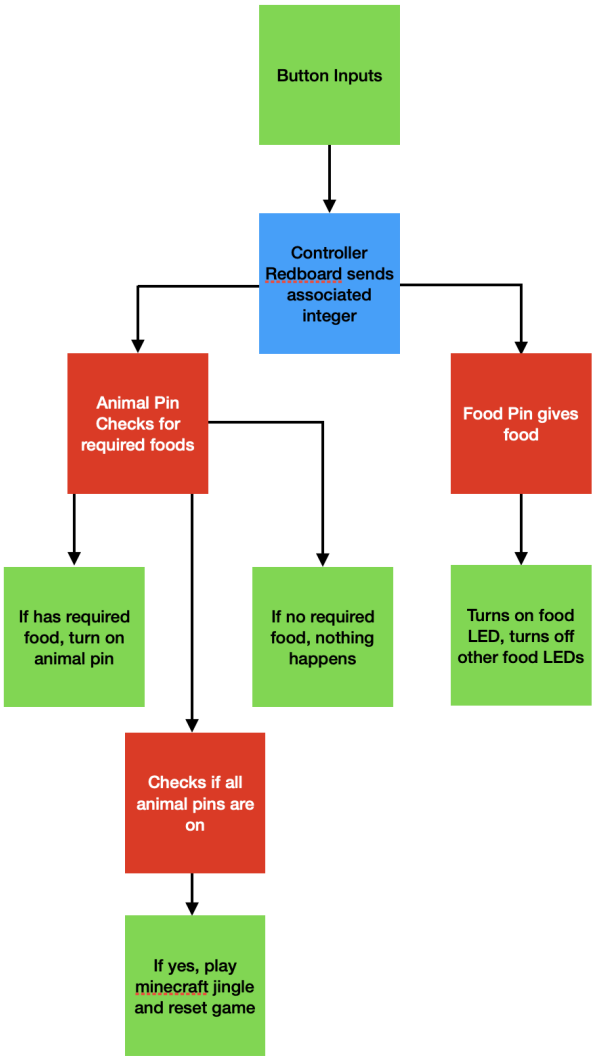
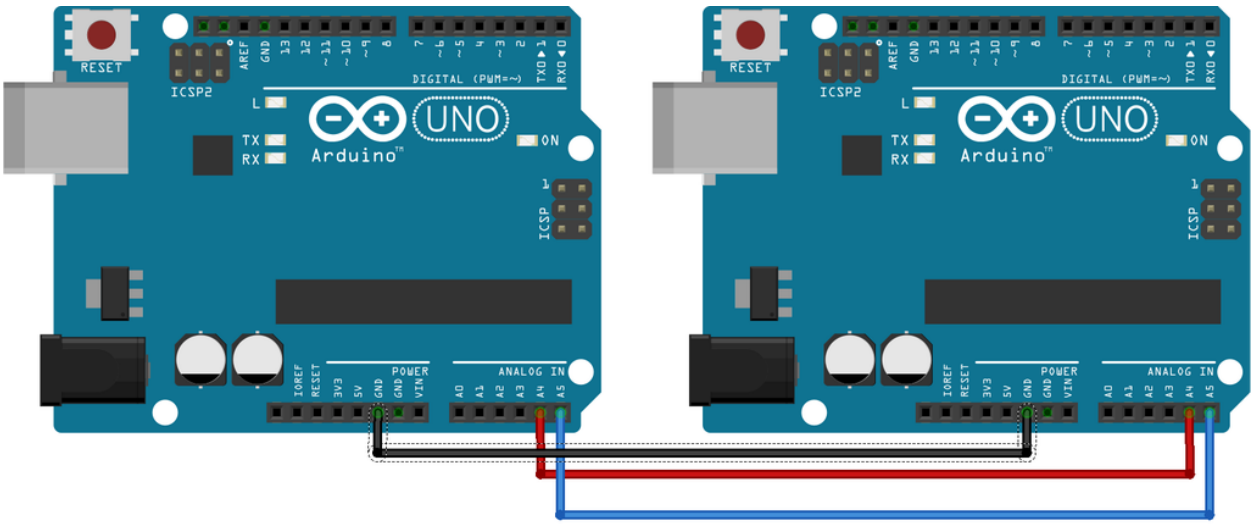



**Figure 7 (**above) displays a flowchart for the game's code, and the logic that runs the game. Green boxes indicate inputs or outputs, blue boxes indicate the controller redboard is being utilized, and blue boxes represent the follower redboard.

Wiring and Electronics

The ‘buttons’ used were the two strips of copper tape connected by the game piece as shown above. The LED’s and piezo speaker components included in our sparkfun kit (collection of electronic components). For the wire.h library to function, the A4 and A5 pins needed to be connected, and the grounds needed to be connected. This is shown in figure 8. Other than this, the LEDs, Piezo and buttons were connected to the designated redboards normally. Each LED had one pin going to ground and the other going to its pin on the follower board, and each button had one pin going to ground and the other to its pin on the controller board. The piezo speaker was connected to the follower board and used an analog input, but was also wired normally with a resistor and pins going to its specified pin and ground.

**Figure 8** shows the connections necessary for the redboards to communicate.




Analysis

Unfortuantly only one of our team members was able to attend the event; The rest had classes to attend. During transportation some wires came undone. Arjun was able to fix that. During the event some of the children pulled out more

wires shortly after the game started working. As a result some electronics were not working while the game was at the museum. Luckily, the children did not notice nor care that the electronics weren't working properly. They enjoyed the game! They liked that it was Minecraft themed; Many of them were familiar with it. They also liked the prize token becasue it was an easily-recognizable Minecraft Steve Head. We expected the game to take 2-3 minutes to complete but most children took about 5 minutes. The children enjoyed our game and that was very rewarding for our group.

## Conclusion

We succeeded in making a game that was fun for children of all ages. It was simple and easy to understand. The children had lots of fun playing our game and that was the main goal of our project. It was safe and didn't include any of the materials the museum prohibited. If we were to redo this project we would have to make it more durable, likely soldering the wires to make sure they can't be pulled out as easily. We learned much while creating this experience, and it was a great way for us to use what we have learned in Cornerstone throughout our first year as engineers. We worked within the constraints of our project and we fulfilled all the objectives.