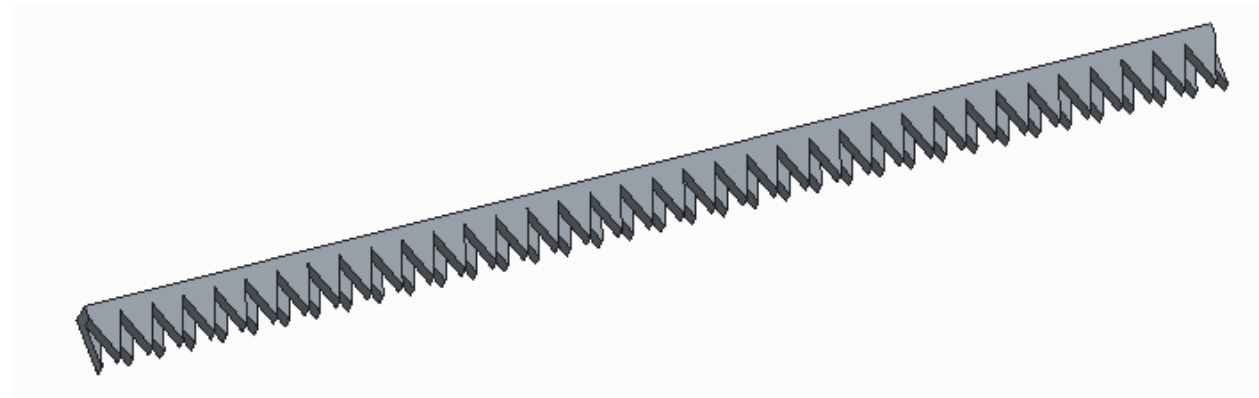


Teeth

The teeth concept works by having a layered set of teeth, as seen in figure ..., that will vibrate back in forth which will lead to the cutting the weed or pulling the weed from the ground. One concept with the teeth is to have the material made out of a metal such as aluminum and for the ends of the teeth to be somewhat sharp. This idea is basically the same concept of how a hedge trimmer works. Another idea is to have teeth that are dull and made of rubber that translate slowly in one direction. This in theory would allow for the teeth to trap the weed and pull it out of the ground. For our design we decided the sharp teeth that vibrate back and forth would be a more viable option because each weed is a different length and therefore one would not know how long the rubber teeth would have to translate to pull the weed out of the ground.

The material that would be used for the teeth would be some sort of an aluminum alloy because the material needs to be strong enough to cut the root system and be able to perform under to top layer of soil. Aluminum is a common material and will be easy to cut and shape. The edges of the teeth will need to be sharpened to a high enough degree that would allow for the aluminum to cut through the weed by just having the two layers translating back and forth.

Some manufacturing considerations are the teeth will not be allowed to go under more than one inch of soil so this will need to be taken into consideration when designing this concept. The size of the teeth will depend on the size of the robot because the teeth will span the entire width of the robot. Another aspect that needs to be taken into account is that another motor will be needed to drive the teeth back and forth.



Some advantages of using this idea is that the design would be cost efficient and easy to design. Aluminum is not a very expensive material and the concept of the design is an easy one to grasp if you consider how a hedge trimmer works. Also the process of cutting the weeds would be fast considering the robot only has to drive in a straight line and the teeth will affect everything in its path and is not dependent of the speed of the robot. The teeth will be fairly reliable if they are strictly going through soil and weeds. However if the teeth encounter something hard such as a rock the aluminum will probably be affected by the contact with the

rock. One major disadvantage with this design is that it might destroy the root system. Due to the fact that the robot can only disturb the top inch of soil the teeth might just cut the weed instead of pulling the root system out of the ground and destroying the weed completely.

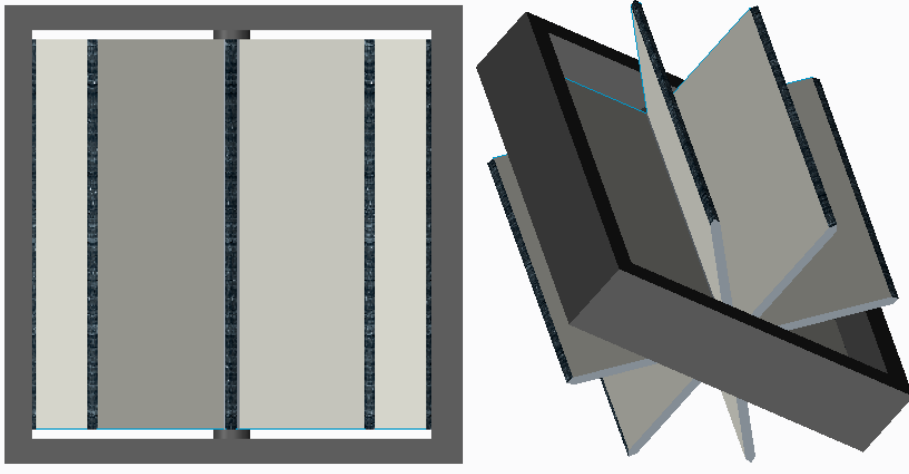
Categories of importance to our group which will help us make our decision to what design we will use are simplicity, weeding effectiveness, speed, cost, construction, and durability. The design would be fairly simple to design however we would have to take into consideration a motor that will drive the motion of the teeth which may complicate the design. The teeth would be effective at cutting the weeds but may not be able to destroy the root system of the weed so the weeding effectiveness is moderate. The robot could operate at higher speeds if this design were used because no matter how fast the robot is moving the teeth are still going to affect the same amount of area. This design would also be fairly cost efficient because aluminum is not an expensive material but a motor to drive the teeth would also have to be purchased. Construction of the teeth would also be fairly easy because the aluminum just needs to be cut in a patterned fashion with sharp teeth edges. Since the teeth have to operate underground they could run into something hard in the soil such as a rock causing the teeth to be susceptible to damage.

Revolving Door

The revolving door concept is shown in figure The idea is to have the blades work essentially like a revolving door that is constantly spinning. The front blades will push the weed toward to wall where the weed will get trapped between the wall and the blade. Once the weed is trapped the blades keep spinning which will cause the root to be pulled out of the ground and will released out of the backside. For this design concept multiple “doors” will be needed so it can cover the full width of the robot. This is due to the fact that the blades will need to be close enough together to capture the larger and smaller weeds.

The frame and shaft will be made out of some aluminum alloy so that they are strong enough to support the spinning blades but also light enough so that it won't weigh down the entire robot. The weight of the robot is of importance because our sponsor does not want the soil to be compacted more than $\frac{3}{8}$ th of an inch. The blades would also be mad of an aluminum alloy but the ends of the blades will have rubber flaps. These rubber flaps will come into contact with the inner part of the frame which will trap the weed and lead to pulling it out completely.

Manufacturing components that need to be taken into consideration is the fact that you will need multiple revolving doors. The idea behind this is that the blades need to be small enough and close enough together that they can trap the smaller weeds as well as the larger ones. If the blades are too far apart the weed will not go all the way to the wall and will not be pulled. Also a motor will be needed to drive the individual shafts which will in turn spin the blades and run the weeding mechanism.



Simplicity, weeding effectiveness, speed, cost, construction, and durability are the main categories of concern to rate our design. This is one of the harder concepts to design because all of the dimensions would have to be perfect in order to have the blade trap the weed on the wall and pull it out of the ground. In theory if the product were to work it would be effective in picking weeds because it would pull all of the weed out including the root. This design require the robot to move slowly because the door would need to go through the whole process of trapping the weed and pulling it out. This design might also be a little more expensive because there are multiple components to the design and there will be multiple doors. Also a motor will have to be bought that will drive each shaft. Construction might also be a little tricky due to the fact that there are multiple parts and the dimensions will have to be cut perfectly to size so that the apparatus will trap the weeds effectively. This system will however be very durable because it does not have to go underground so will not be affected by any hard objects in the soil. Also the apparatus will be water resistant and will not be affected by the rain.