Design of a 3D Puzzle for Building a Robot

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Abstract

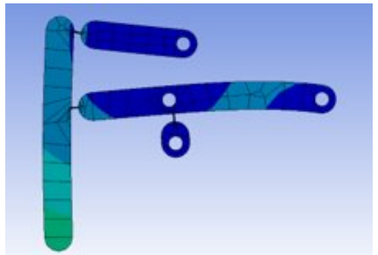
As the need for robotics and automation increases, the importance of the younger generations getting an early introduction to robotics will increase as well. The challenge is to create a robotics kit that will not be overly priced to manufacture or sell. The robot should be like a puzzle, where the user will get instructions, a workbook, and an unassembled robot that they will have to assemble themselves. The assembly process will be able to teach the individual how the leg designs of the robot will work. The workbook will have the wiring schematics of the electrical components, as well as information and lessons on programming all the components to work together. The robot should be quick to assemble.

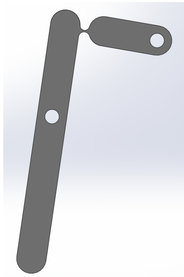
Motivation

To create a method for teaching robotics to younger students will be beneficial for individuals with interest in pursuing robotics. The students should be able to learn different aspects of robotics from the kit that would be provided. Through the assembly process, they will be able to learn by seeing how the linkages of the leg work together to create motion, and how the components should be fastened together. The electronic components should be able to teach these students about the wiring that is needed to connect all the components together as well as the programming needed to allow these components to ensure the walker functions efficiently. The goal was to create STEAM intensive workshops to have students explore and play with the robotics kit and to fully have an impact and create conversations with students on robotics.

Living Hinges

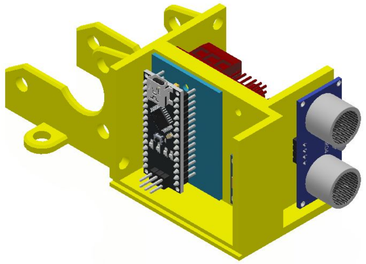
Living hinges are thin flexible hinges and are made of the same material as the two rigid pieces it connects. The walker legs had some joints that were replaced with living hinges to shorten the time needed for assembly. These new leg designs were cut using a waterjet, cutting material with a living hinge thickness of 0.045”.

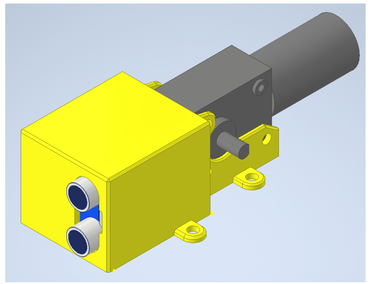




Electronic Programming

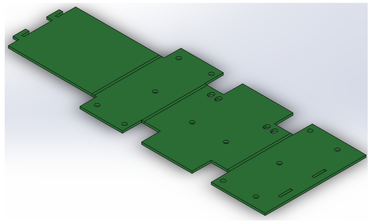
The robot includes an ultrasonic distance sensor, Arduino nano, and motor driver to control the motion of the robot. However a second variation of the circuit can be built with a 6-axis accelerometer so it can be used to study the dynamics of the robot. These electrical components are then put into the designed electrical housing.

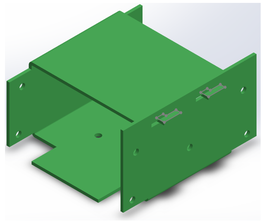




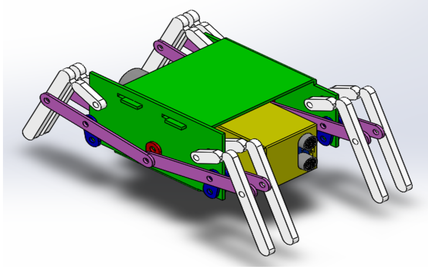
Assembly

The base of the robot can be folded into shape from a single flat sheet of polypropylene due to the 90˚ grooves that were milled.





After the base is folded the legs and electronic housing can then be mounted for a completed robot



Conclusions

The 3D puzzle robot is a great tool for students to learn and gain interest in the STEAM field, by teaching them how to build a robot and allow children to get a hands-on experience with robotics.

Acknowledgements

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