MIM JOURNAL 2023 illuminate your work
Made in Millersville Journal | www.mimjournal.com

Garfield: The 3D Printed, Fully Articulated Cat

Konrad Bernardino, Caitlin Gibson, Braxton Lippold, and Regan Stump

Abstract

As part of the computer aided engineering drawing class taught by Professor Cindy English, groups of four students researched, designed, and built a 3-dimensional articulated figure using computer aided drafting software and a 3D printer. This group created Garfield, the beloved cartoon cat created in the 1970's. The figure has eleven different parts (unique geometries) and is fully articulated. These parts included one head, one body, two arms, two legs, two hands, two feet, and one tail. Solidworks, a 3D design software, was used to design and render the figure. The parts of our multicolor 3D figure were then 3d printed using a MakerBot FDM printer and then assembled. When completed, the figure could not exceed 6" x 6" x 6".

Introduction

What is an articulated figure? It is a figure that is built in pieces and assembled using joints. The neck, shoulders, arms, legs, and torso are assembled using joints. To create a 3D articulated figure, the process includes the initial design, a primary sketch of each body part, a bill of materials template for each body part using Solidworks, the 3d printing process for each body part using a MakerBot rapid prototyping device, sanding of each part to ensure a proper fit of the body parts to the articulated joints, and finally, the assembly of the printed body parts to create one recognizable figure.

MakerBots in Osburn Hall, Room 300

Method

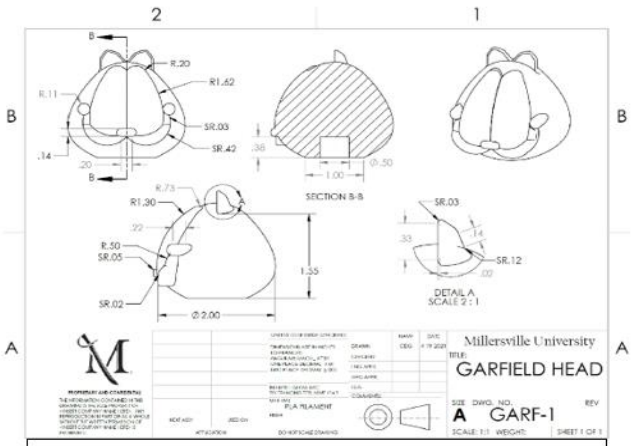
The first step in the process of creating Garfield was drafting a primary sketch of each of Garfield's body parts. Students were required to use 3rd angle projection, a method

of orthographic projection portraying a 3D design using a series of 2D views of an object. Orthographic projection is when an object is depicted using parallel lines to project its image onto a plane. Drawings needed to include an appropriate number of views of each body part, including an isometric view. An isometric view of an object is obtained by choosing the viewing direction such that the angles between the projections of the x, y, and z axes are all the same, or 120 degrees. The body parts sketched for Garfield include the head, the body, the arms, the hands, the legs, the feet, and the tail.

The second step in the process of creating Garfield was drafting the bill of materials (BOM) template for each body part using Solidworks. In this instance, the bill of materials is the complete list of all the items that are required to build a Garfield body part. This can include all the parts, subassemblies, assemblies, components, and raw materials that manufacturing the part entails. An example of Garfield's subassemblies includes the ball and socket joints for his shoulders and wrists, a swivel neck joint, and swivel ankle joints.

The third step in the process of creating Garfield was the 3d printing process. Three-dimensional printing of each body part was accomplished using the MakerBot rapid prototyping device. The MakerBot involves heating fused deposition modeling (FDM) filament to its melting point and then extruding it layer by layer, building from bottom to top. The filament is a plastic made from polylactic acid that comes in various colors. Polylactic acid filament is used in 3D printing because it is strong and has a low melting point and good layer adhesion. Garfield utilized mostly orange FDM filament.

The fourth step in the process of creating Garfield was sanding each 3d printed body part to ensure that the parts would adequately



3rd Angle Projection Orthographic Drawing

fit together, move, and rotate like actual body parts. Configuring the joints involved patience, trial and error, and brute force to clip the arm and leg sockets together.

Results/Troubleshooting

The most challenging part of the Garfield project was the cat's tail. The cat's fat belly made him prone to fall forward. Special care was utilized to ensure that the size of the tail would enable Garfield's heavy body to rest against the tail and keep the cat in an upright position. Ultimately, the tail was shortened and the feet were widened, and these two specific modifications made Garfield more stable. If our group had more time, we would have shortened Garfield's arms to make them more proportional to his body. This project was helpful in aiding our understanding of computer aided drawing, while allowing us to showcase our group's artistic talent and share our sense of humor with the college community. If you visit Millersville University, you can find Garfield hanging out in Professor English's display case outside of Room 300.

3D Articulated Model of Garfield the Cat

Conclusion

This final project took our theoretical knowledge of computer aided engineering drawing and transformed it into creative action by applying it to a specific problem. Working as a group required patience in choosing our subject, in assigning specific Garfield body parts to each group member fairly, and in getting the cat's joints to fit and articulate properly.

Recommended Citation
Bernardino, K., Gibson, C., Lippold, B., & Stump, R. (2023). Garfield: The printed, fully articulated cat. *Made in Millersville Journal*, 2023. Retrieved from https://www.mimjournal.com/