Residential Window Mount for a Soft Robotic Solar Tracking System

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Research Area

The problem presented was to improve upon a window mount for a soft robotic solar tracking system. I created a "one size fits all" window mount that would allow for easier large scale manufacturing and distribution of the soft robotic solar tracking system created by the SoRo-Track team (Svetozarevic, 2016). This is in comparison to their original window mounting design that would require creating different sized mounts for different sized windows.

Motivation or Background

A dynamic array of solar panels controlled by a soft robotic system provides a lightweight solution to the often bulky and heavy dynamic solar panels that are on the market right now. A soft robotic controlled solar panel array allows for the dynamic solar tracking technology that maximizes the voltage input of solar panels to be used in areas that may be difficult to place traditional dynamic solar tracking systems.
While researchers have worked on improving the accuracy and mechanics of these soft actuator solar panel arrays, not much attention has been paid as to how to mount these solar arrays in a way that can be easily installed and manufacturable in large quantities, an important quality every design should consider if they intend to market the product commercially.

Objectives

1. To create a mounting device that is lightweight and able to fit a variety of window sizes
2. To have said mounting device be easily manufacturable – minimize the amount of variety in parts
3. The mounting device must be able to be installed easily and effectively

Methodology

This design is an improvement upon the mount created by the So-Ro Track team (Svetozarevic 2016). Using SolidWorks I created a mount that holds a solar panel array in tension and can be used on a window frame of up to 79" x 79". This square window mount holds the array through a series of extension bars and springs that, when assembled, creates tension throughout the structure so that screws and bolts are not needed to mount the structure to the window. This design also allows for the length and width of the mount to accommodate various window sizes.

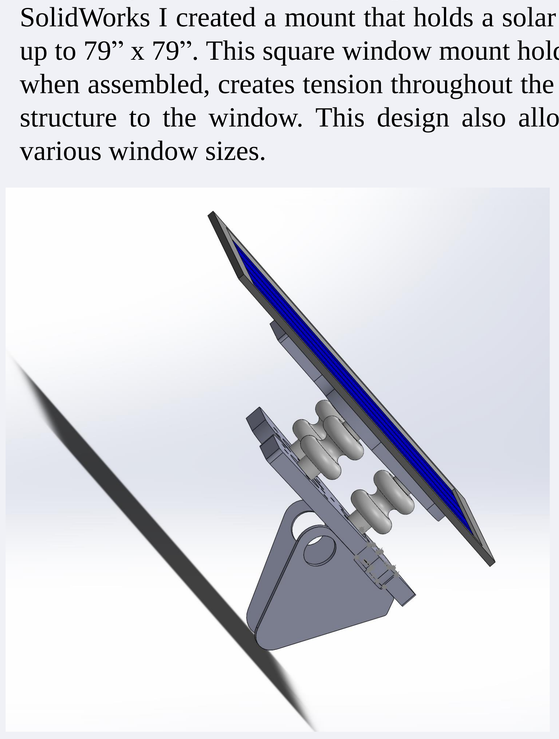

Fig. 1: Solar Panel Mount

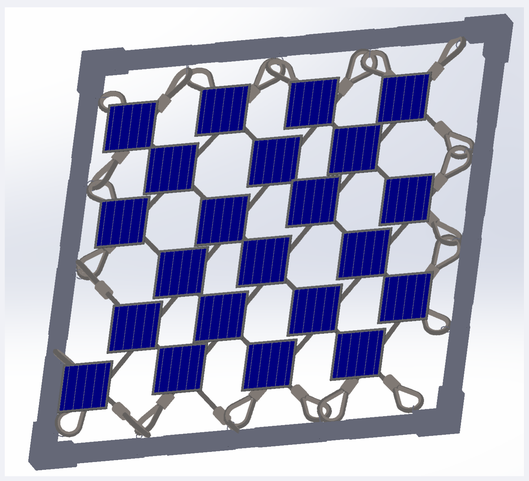

Fig. 2: Assembled Window Mount

Results

In SolidWorks I created four square bars that were 20 inches long and 4 inches in width and height. On one end of these bars I cut in a cavity that was 5 inches deep and 3 inches in length and height to hold the spring and proceeding bar of the mounting system. On the other end of each bar I made the last 5 inches 1.4" x 1.4" so that it would be able to fit into the cavity of the previous bar. To connect all these bars in a square shape I created right angle connectors with two cavities that were 1.4" x 1.4" to fit the ends of the bars. These parts formed the outer structure.

Using SolidWorks I created cables to be strung between the bars and screw hooks to hold them in place on the bars. Next I worked on creating a mount that would hold one dynamic solar unit and that could be strung through the wires. To do this I made made two triangular shaped plates that would hold the three actuator parts of the solar unit. I made sure to put screw holes in these plates so that I could screw the individual actuator plate down to the triangular plate. To attach the structure to the window mount, created two triangular shaped sheets with a hole wide enough to string through the cables. I screwed these into the triangular plates of the actuator plates.

The maximum size this window mount can reach is 79" x 79" and after all the parts were created, I assembled the mount using the SolidWorks assembly feature. This design improves upon the So-Ro Track team's original mounts lack of ability to accommodate window frames of various sizes. Because of my designs ability to fit windows of various sizes, it would allow for an ease in mass production and distribution of the dynamic soft actuator solar tracking system to residential homes.

Skills and Experience

For this design, I had to have proficient knowledge in the SolidWorks program. I also had previously helped a team researching and improving on the design of the soft dynamic solar tracker. With them I helped improve their mold for the soft actuator as well as helped them code some of the earlier solenoid valve controls using an Arduino.

What I Learned

This research project allowed me to apply my critical thinking skills to a real life problem and come up with a solution. For this design I had to consider what faults I could find in an original design and create solutions by applying what I have learned in physics. In creating this design, I was able to improve my skills in the SolidWorks application as well as gain experience in the planning and execution of a design project.

Future Plans

I plan to improve upon this design by making it more symmetrical. This can be achieved by adjusting the placement of the screw hook holes as well as adjusting the hoop size of the cables. I also would like to create a way to allow for a wider and longer structure to accommodate the larger windows of offices.

Acknowledgments

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References

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