

TO: Seunghwan Jo (jo30@purdue.edu)
Nathan Wang (wang4425@purdue.edu)
FROM: Nate Saul (nmsaul@purdue.edu), Team Nugget
DATE: April 16th, 2022
SUBJECT: D7 Engineering Models



The purpose of this model is to develop an engineering model in order to predict and evaluate the arm opening and closing device and the force required for it to open and work effectively.

Our final problem statement is that opening doors with your hands can be unsanitary and inconvenient, there should be a hands-free way to open doors. In our design, the user steps on a foot pedal which then pushes fluid to a piston on the top of the door. Then, an arm pushes the door open slowly, allowing the user to go through the door. This model analyses the force used to push the door open and the velocity and angular velocity of the arm bars.

This model goes into detail on which angle will give the greatest and least velocity to open the door. It also goes into what force will be required so that the door can open fully using the arms.

When creating the model, I had to take into account all of the forces and lengths that go into the design. It is limited in the assumption that the brace will stay against the wall and that all of the applied force is on one side of the bar. Finally, it does not cover all of the upward forces on the door, just for the hydraulic force that acts on the arm bars. A potential improvement for this design could be to account for all forces acting and to use the force applied to the whole entire arm not just at one point.

Finally, the model helps us understand our design better. In the model, it shows how the max velocity is at the beginning and end of the door opening process, which will affect how a person can go through the door. The middle is the slowest part of the door opening process, which allows the user to hurry through the door before it closes again. Finally, we can see that a relatively large force is needed to open the door, as you can see from the model (around 800 N). This makes sense because a person around 80 kg or 170 lbs will be required to open the door. We may have to find a way to lower this in order to allow for easier access for children or any smaller adults. All in all, the model shows we are doing well in our design process, but we still need some improvements in order to create a completely finished product.

If you would like any further details, please contact me at the following email: Nate Saul (nmsaul@purdue.edu).

Sincerely,
Nate Saul

Nate Saul

Attachment:

- Engineering Model.pdf