



Highly Commended

**Programming, Apps &
Robotics
Year 3-4
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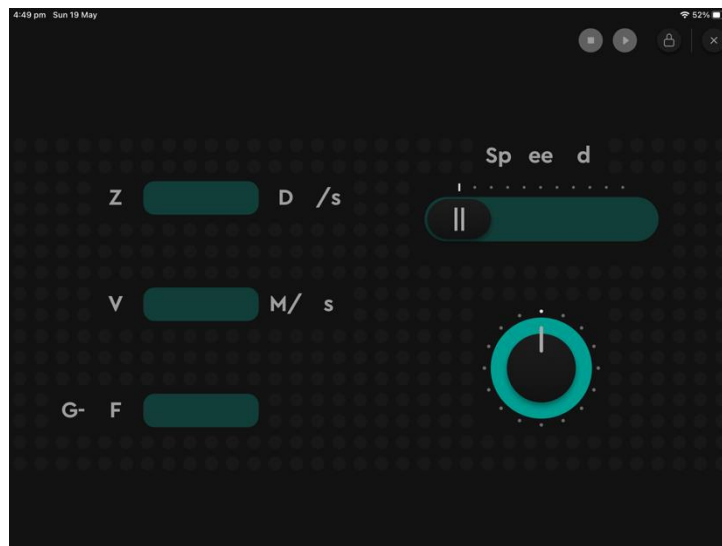
St Peter's College



G-Force Trainer

My project is a centrifuge, which is used in real life to train astronauts by putting g-forces on the astronaut. The aim of my model is to teach kids about g-force. My centrifuge spins at a controllable speed, and then shows the approximate amount of g-force it is putting on the astronaut figure. To build and program the robot, I used Lego Mindstorms.

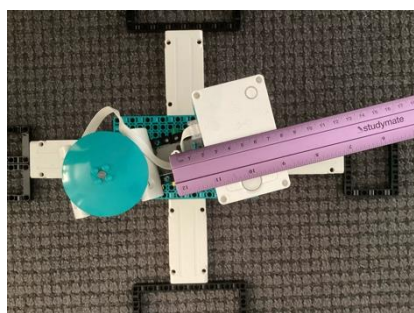
How To Use The Model



To use the centrifuge, you first move the slider, marked 'speed' to spin the centrifuge at the speed you want. The circular dial will show the speed. If you look at the display marked 'g-f' it will show the amount of g-force that is being put on the astronaut figure. The display marked 'V' shows the velocity, which is metres per second, of the spinning part. The display marked 'Z' shows angular velocity Z, which is degrees per second.

How The Program Works

When the program starts, it sets a variable called 'Radius' to 0.05m, which I have measured as shown below.

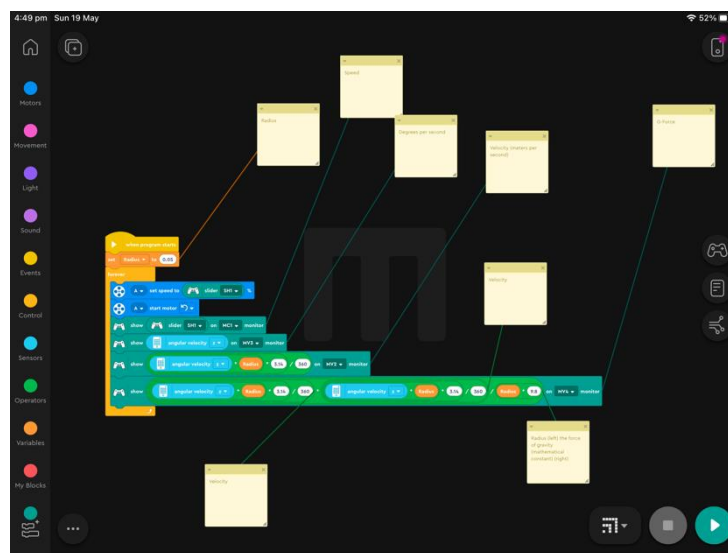


Then, in a forever loop, it sets the motor speed to the slider position, and then starts turning the motor. It also shows the slider position on the circular dial. It shows angular velocity Z, which the hub measures, on the display labeled Z. After that, it does this velocity calculation, and shows the answer on the display labeled V:

$$((\text{Angular velocity } Z * \text{radius}) * \pi) / 360$$

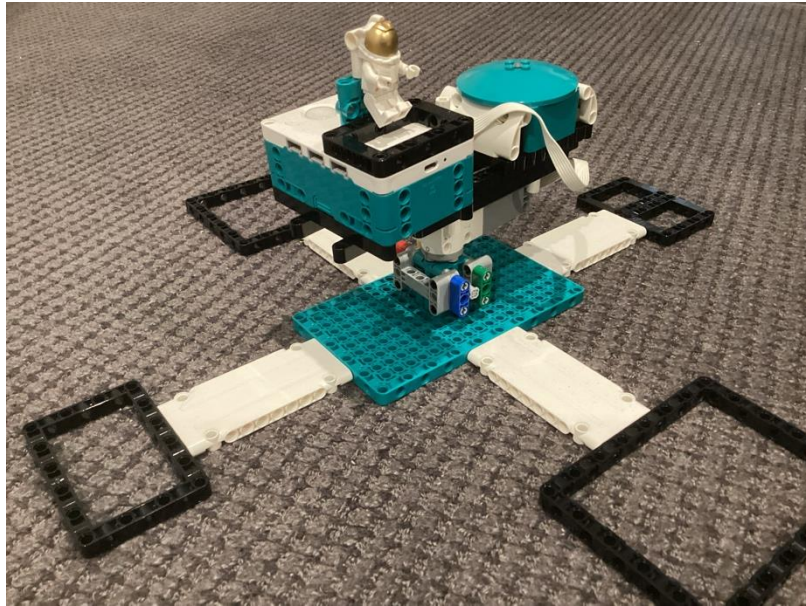
This calculation turns angular velocity (degrees per second) into meters per second, the type of velocity that is needed for the g-force calculation. The next calculation shows the g-force on another display.

$$\text{Velocity}^2 / (\text{radius} * \text{gravity})$$



This sequence is repeated, so that the displays and the motor speed constantly updates.

Finished Model



Acknowledgements

My dad helped find the formulas online.

These are some of the websites:

<https://science.howstuffworks.com/science-vs-myth/everyday-myths/question633.htm>

<https://docs.pybricks.com/en/latest/hubs/primehub.html>