MICHIGAN STATE UNIVERSITY

Design a Robot

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Introduction

This poster show the findings, calculations, and design process in developing a remote-controlled robot. The following data was sampled from a 90 second time trial.

The robot is comprised of 4 wheels, a large claw, and an adjustable arm. Allowing the robot to move up slopes, pick up items, and change direction. Parts and instructions were given in the construction of the robot.

Methods

The design took roughly two days to produce, where we finalized the current design used (See figure 1). The final design uses a claw arm that allows the robot to pick up items more accurately and with ease.

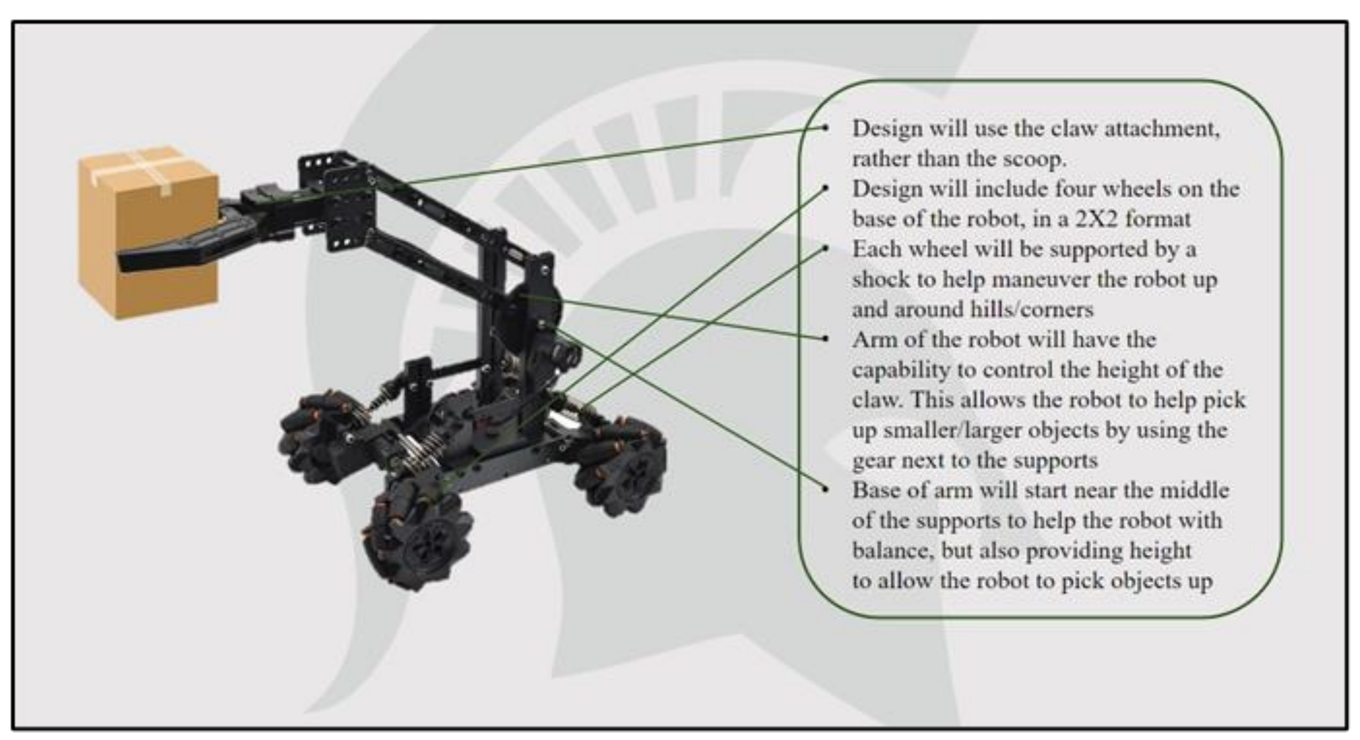

Figure 1. Finalized robot design including key features on robot.

Data was collected to allow for the team to measure the forces that act on the robot, such as: velocity, acceleration, and drag force.

The following equations were used to calculate the drag force acting on the robot, velocity and distance traveled over time.

$$T - F_D = m * a \qquad [1]$$

$$F_D = \frac{1}{2} C_d A p v^2 \qquad [2]$$

$$v_t = v_{t-1} + a_{t-1} * \Delta t \qquad [3]$$

$$y_t = y_{t-1} + v_t * \Delta t \qquad [4]$$

Results

It is clear that the faster the velocity, the higher the drag force will be for the robot. Graphing this data assists in displaying the relationships between Velocity and Acceleration (see Figure 2).

The results from the calculations (Figure 2) display that the further and faster the robot travels, the higher velocity. Velocity is also seemingly inversely related to acceleration as when velocity is increasing as time goes on.

This is likely because of drag on the robot. As the robot accelerates and gains more velocity, the drag will also increase

This decrease in acceleration and velocity will almost certainly decrease drag as the robot would eventually come to a halt because of resistances that are acting on the robot.

Table 1. Small sample of robot distance, velocity, acceleration, and drag over a time interval of 4 seconds.

Time (s)	Distance (m)	Velocity (m/s)	Accel (m/s/s)	Drag (N)
0	0	0	0.1429	0
1	0.0707	0.1413	0.1425	0.0005
2	0.2838	0.2833	0.1414	0.0020
3	0.6383	0.4239	0.1396	0.0046
4	1.1322	0.5623	0.1371	0.0081

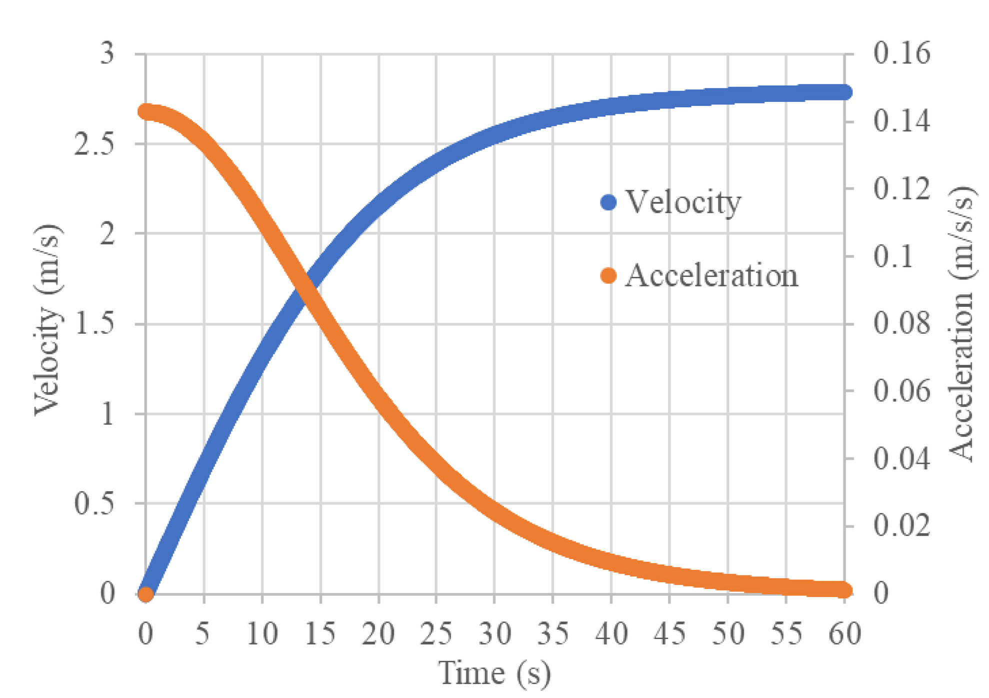

Figure 2. Robot's velocity and acceleration graphed along a time of 60 seconds

Figure 2 also illustrates the inverse relationship between velocity and acceleration. The reason that acceleration will eventually become zero and acting forces also limit the robot's top speed.

Conclusion

Robotics has also been important to the study of engineering and providing students with a new way of learning integral problem-solving techniques and social skills

Within this project, this is shown as relationships of velocity, acceleration, and drag force have been better understood and improved our problem-solving techniques when building the robot

Robotics can be a great way for new engineering students to be motivated to continue their pursuit of a degree in engineering. This being applicable for all as it has introduced what engineering as a profession may be for most of us in the future

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References

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2. L. J. Karam and N. Mounsef, “Background,” in Introduction to Engineering, Switzerland: Springer, 2008, ch. 8, sec. 8.1, pp. 101