



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Tyler Billman; Anurag Gajaria; Briana Marquez</b>	<b>Project Number</b> <b>S0304</b>
<b>Project Title</b> <b>The Optimization of the Mechanics of a Robot</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The primary purpose of this project is to use physics and mechanical engineering concepts to produce a multi mechanism machine with the highest calculated ideal and experimental efficiency. We combined the concepts of gear ratio, torque, levers, and ideal mechanical advantage to essentially optimize the mechanism implemented on our robot/machine.</p> <p><b>Methods</b> Our first design was made as a base model that would then be adjusted to increase efficiency. The base model was constructed of steel metal parts, a ball shooting mechanism, an elevator like mechanism, and a lifting mechanism. We used several robotics competitions as our test grounds to see how the complete product would work. The first design failed, the motors burned out due to excess weight and not enough force. From that first design we simplified and modified our machine, changing out the type of metal to reduce the overall weight of the design as well as calculating the ideal mechanical advantage of each mechanism to idealize the entire machine. Using a specific equation we predicted the mechanical advantage of each design and after our test runs we were able to calculate the efficiency of the design and then modify to increase that efficiency.</p> <p><b>Results</b> After the several robotics competitions, observations, and modifications, it was concluded that the most successful machine was an aluminum and steel design with less and more simple mechanism. Our final machine consisted of both aluminum and metal parts, with only a drive train and a claw which were both made most ideal using both calculations and modifications to adjust to the objective of the robot.</p> <p><b>Conclusions</b> These mechanisms directly correlates to several engineering disciplines, from bioengineering, mechanical engineering, to robotics. Our experiments revealed how simple it actually is to make everyday machines more efficient, with the knowledge of the simple algebra that goes into these concepts anyone could modify their machines according to their preference or need. It is these concepts and mechanism that are used to make such innovative machines as a prosthetic robotic arm, such simple concepts that can produce machines that improve everyday life.</p>	
<b>Summary Statement</b> This project utilizes physics and mechanical engineering concepts, specifically gear ratio, torque, levers, and ideal mechanical advantage, to produce a multi mechanism machine with the highest calculated ideal and experimental efficiency.	
<b>Help Received</b>	