Simple, Yet Effective Mechanical Designs
Zachary Duca and Rob Kendall
Malden Catholic High School
zduca4@gmail.com, r.kendall.j@gmail.com

Simple, Yet Effective Mechanical Designs

1 Pulleys

When experimenting with different types of building techniques including things such as strength of motors or servos, one will eventually find that there are certain methods to attain the most ridged, strongest, and most compact way of creating certain robotic systems. One of these systems used was a pulley. After much trial-and-error testing, the pulley seems to be one of the most useful systems that we have attached to our robots. Pulleys are a very unique and strong system due to their ability to increase the lifting or moving capability of a motor or servo. Pulleys also are somewhat compact by design due to their simplicity, using string to avoid a usually large structure of bound parts. By using the pulley, you are for one eliminating parts which will help your overall building process, as you will have more parts to build with, and two, you are eliminating the weight of those parts which adds to the moving power of the motor or servo in addition to the added power the motor has gained through the pulley system. For example, if our team made a solid claw mounted in a one-piece fashion, it may only be able to lift two rubber ducks, but if we use a pulley system, it could have the ability to lift three or four rubber ducks. They pulley system has proven to be a great advantage in the critical performance tasks of our robots.

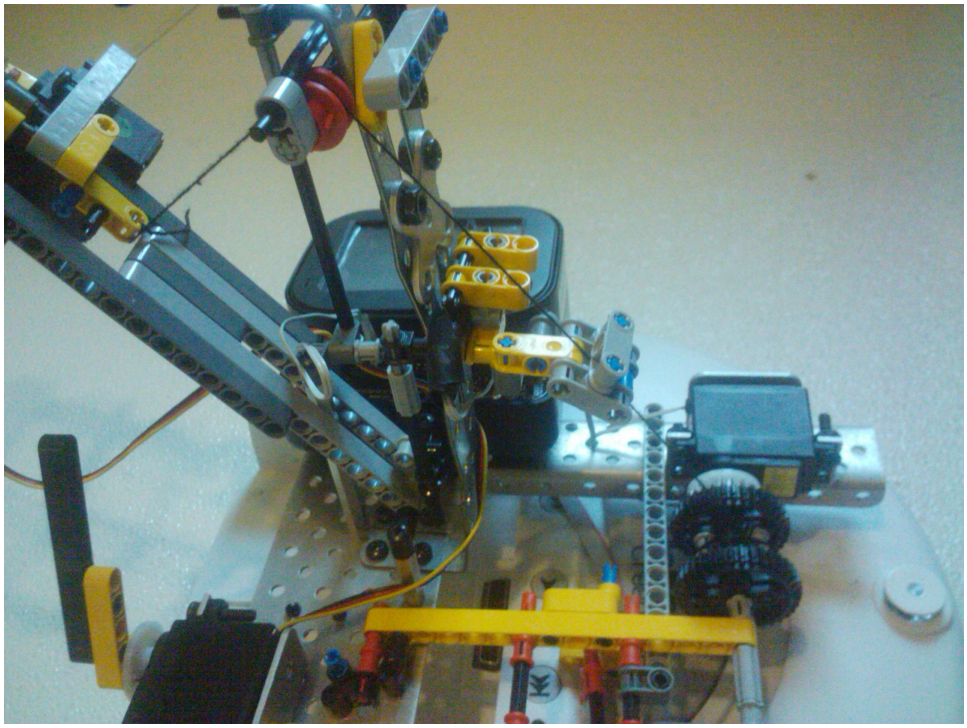

Figure 1: Pulley system used on our team's Create-based robot to allow lifting of heavy objects.

2 Bins

With a greater abundance of pieces to work with this year, we had contemplated and created a new type of mechanical system that had greatly improved our efficiency in scoring points and performing tasks. This mechanical design is what we call a “bin.” The bin is designed in a cage-like fashion in order to store game-board pieces such as frogs in the robot. The bin is one of the robots most crucial parts for many reasons. For one, the bin provides a method to obtain game pieces and store them on the robot rather than moving back and forth between point of origin and dedicated collection area. The bin gives the robot the ability to perform its tasks more efficiently, being able to keep moving while performing tasks and having the ability to only go back to collection areas when the task is complete and time is running out. A bin created with a reasonable amount of allocated parts can also hold a large amount of game pieces, for example, every single frog and Botguy. The bin, while simple, proves to be an integral part for a robot tasked with gathering a large amount of game pieces.

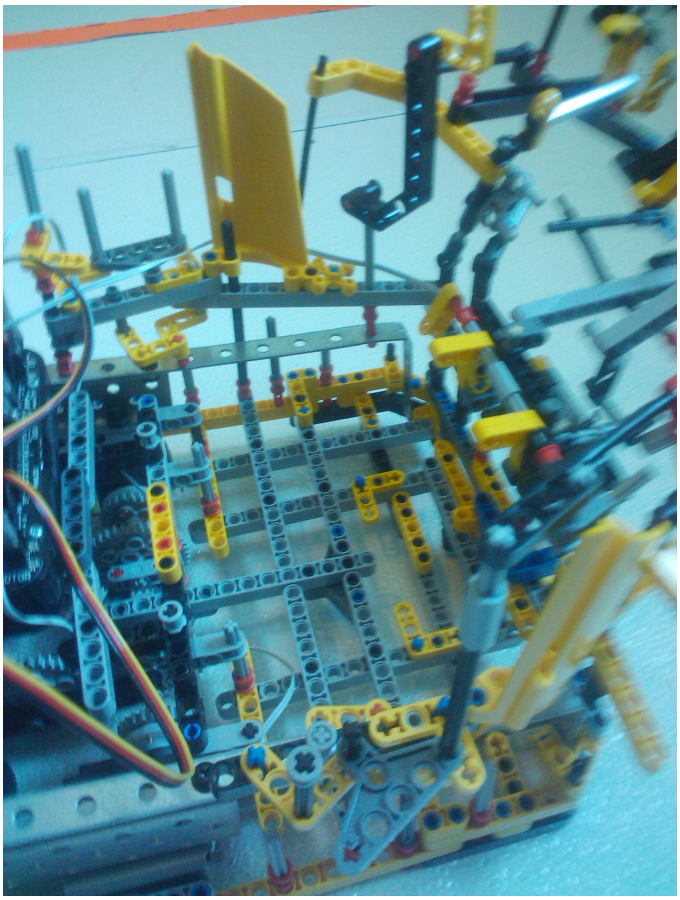

Figure 2: Bin used to store all 24 frog tribbles and Botguy.

3 Elastics

Elastics are very useful for picking up heavy, oddly shaped objects, like ducks. They offer increased friction and quicker pick-ups, especially when used on claws. Objects held only by claws made of Lego pieces can fall out easily. Elastics placed on the tip of the claw provide more friction so the objects will not fall out as effortlessly. When our team first built a claw for picking up ducks, the claw was strictly Lego pieces. However, after testing, we found that the ducks would slip out of the claw. Therefore, we attached four elastics to the top and base of the claw to ensure that the ducks would not fall out. The addition of the elastics also allowed for a larger claw. With the elastics, our claw could consistently pick up three ducks at a time instead of just one or two occasionally. Elastics are very useful game pieces and have proven themselves crucial to the gathering of rubber ducks and other game-board items.

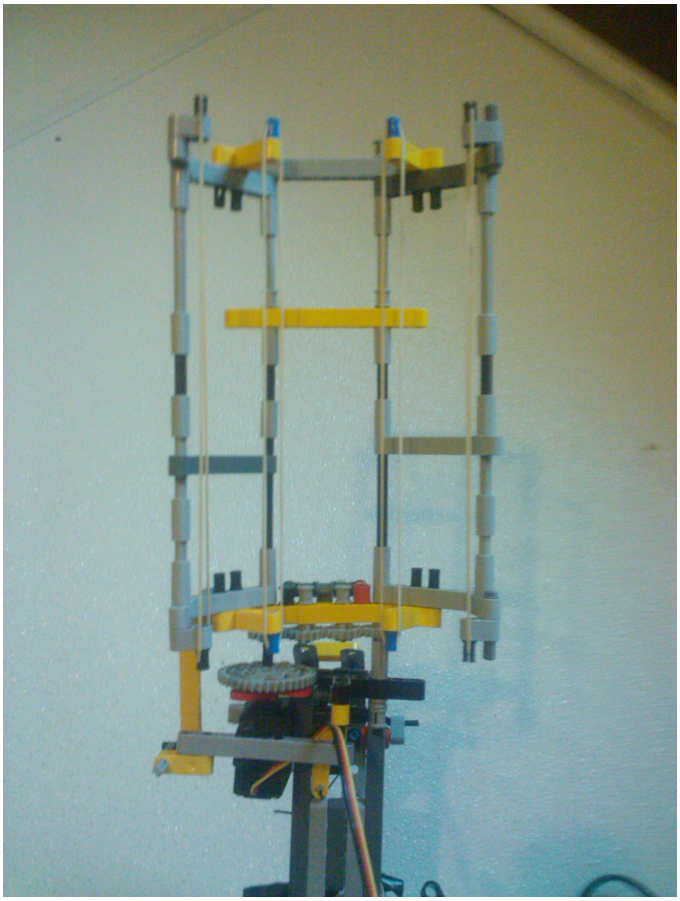

Figure 3: Duck claw fortified with elastics to ensure efficient grabbing.

4 Do Not Use Cameras!

Cameras would usually be considered, out of all the sensors in the Botball kit, the most efficient ones. However, as it turns out, they are often slow and unreliable. Blob-tracking with a camera can take an extremely long time, often taking away many precious seconds that a team could use to drive to the other side of the game board and back. Our team, when using blob-tracking to locate and gather the oily ducks, found that blob-tracking would take up too much time and be too inconsistent. The robot would have to search slowly so the camera could process and remain accurate, and many times the camera would track variations and reflections of the white game board surface as yellow. This inconsistent tracking would cause the robot to gather a shadow of what it thought to be an oily duck. Many other teams also had difficulty tracking specific colors, like the red of Botguy. This problem results from colored shirts and objects in the background of the game board. The camera, then, if using blob-tracking, will track the larger background blob instead of the game piece or objective. This obstacle is basically unavoidable because there is always at least one person wearing a red or yellow shirt in the audience.

One suggestion from my team would be to use other sensors, like ET's and sonar sensors. Since objects are, for the most part, always located in the same position every game, a camera is not really needed anyways.

References

None- All references, including the photos, are opinion-based and facts from our team's 2010 Botball season.