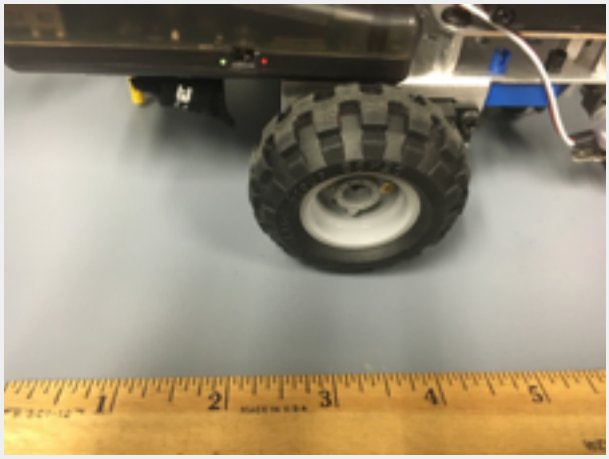
Explorer Post 1010
Botball Team 16-0160
Greater DC Region

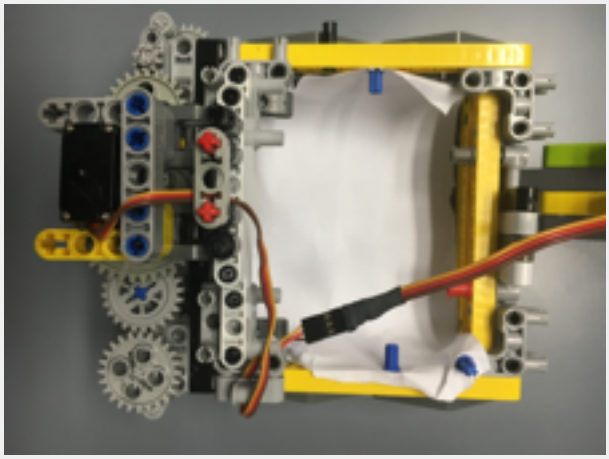
Period 2 Mechanical Design

DRIVE TRAIN



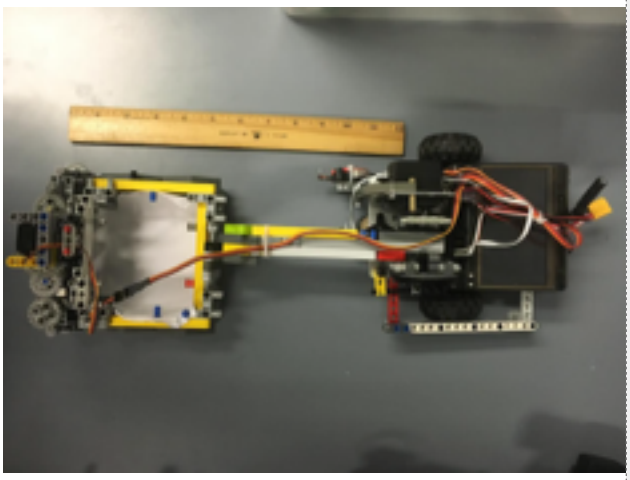
- The drivetrain style depicted to the left is a simple motor to wheel system. This means that the motor is attached to the metal chassis included on the parts list and then to the wheel. The wheel selected is also significant because the cylindrical shape of the wheel (as opposed to a flat surface) provides superior grip.
- This compares to the technique of using gears minimize the number of motors used. However, our team felt that that design ran the risk of poms getting caught on the wheels. Since the game board included many poms and their positions could not always be guaranteed, the risk was not deemed worthwhile.

EFFECTOR



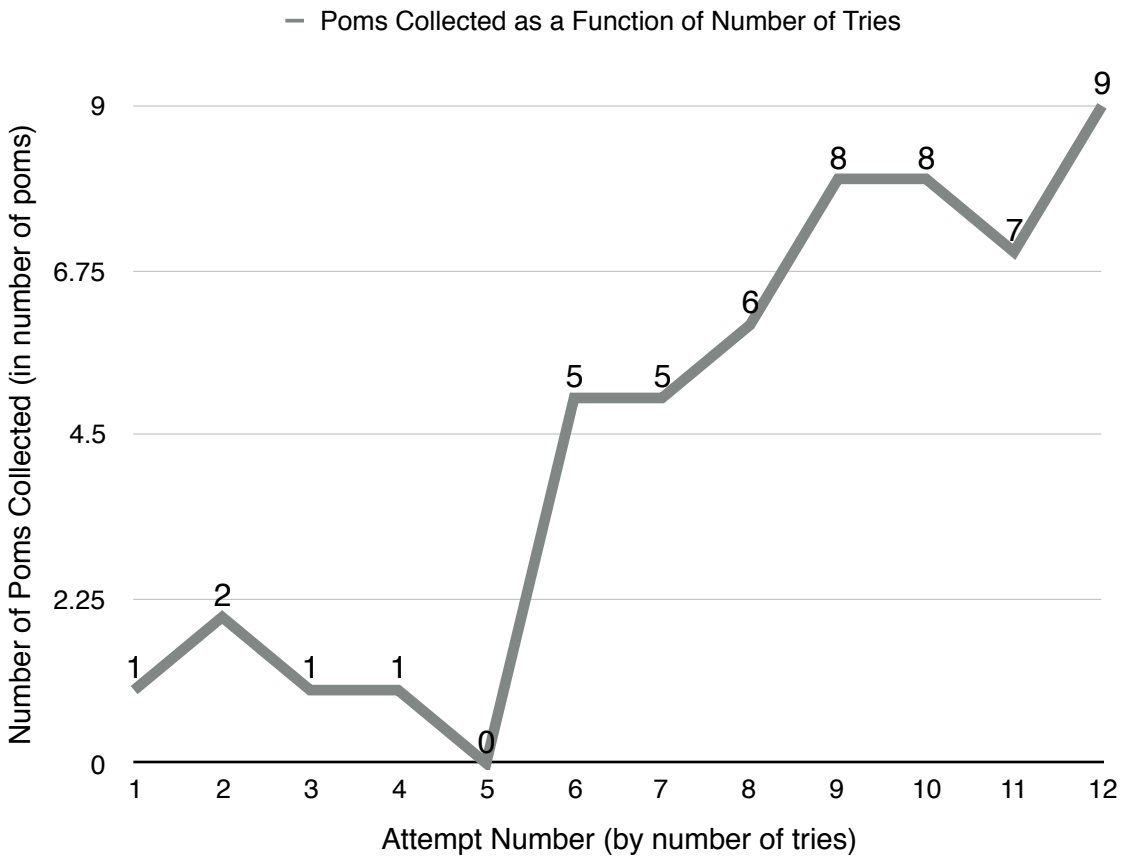
- This effector design features a sturdily built bin made out of lego and two movable doors operated by a miniature servo at one end. These doors open and close so that as the bot moves forward, poms are collected in the bin, ready to be dumped in the bin on the game board.
- This was inspired by water flow, because the goal was to control the “flow” of poms. Thus our design mimics a canal water lock, where the waters is released into the lock in a controlled manner so that it may be utilized (or in our case stored to collect points) Our team selected this design because we needed a solution that encompassed both catching *and* transporting the poms.

SENSOR MOUNT



- This sensor mount design features a long but strong arm that connects the effector to the robot. The weight of the effector is balanced by a gear system that shares the weight with the servo so that it does not break (as the effector basket is heavy)
- This was inspired by cranes seen on construction sites. As with most cranes, the materials used are so heavy that the actual weight cannot be supported by motors alone. Thus the weight is shared to the motor focus more exclusively on moving the supplies up and down. The team decided on this design because the basket was more time efficient but for it to work there needed to be a way to lift it.

Data



- This data was collected by running the Wallaby robot through the current code and recording how many poms it managed to collect in its effector/basket. The robot started in the starting

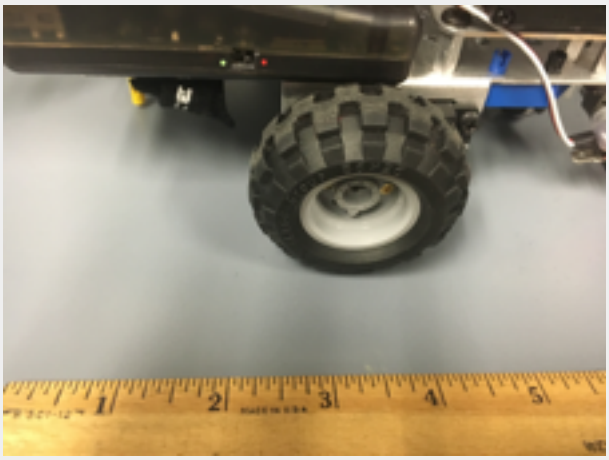
box and would run through approx. 1/2 of total code (only the segment concerning the collection of poms as the other sections involve the other robot).

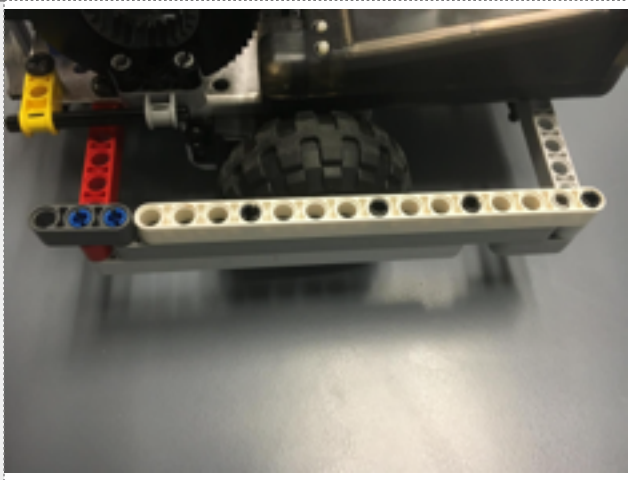
Data Evaluation

- The parts being tested were the drive train and effector. In other words, the accuracy of the robots movement and the ability of the effector to gather poms. The data relates to the part being tested because it portrays the continual attempts and steady improvement of the robot's navigational skills (there were fewer issues with the effector as it turned out).
- In the data, there are three trends:
  - The first shows that during the first five tries the robot captured little to no poms. This marks the period of time when the team realized that the navigation of the robot was skewed because the regular wheel could not stay in steady because imbalances with the motors would cause it to veer left. The builders and programmers attempted multiple times to change data values to balance these issues but soon abandoned the attempts in favor of a more concrete solution.
  - The second trend spans the 6th through 9th tries as the new self aligning bumper was added. The bumper allowed the robot to guide along the PVD pipes and vastly improved its navigational capabilities as the issue with veering was eliminated.
  - The final trend that spans (and continues beyond) the 10th to 12 attempt captures the improvements by the turn by angle code. While most angles are made through a combination of a specific more speed either clockwise or counterclockwise for a set time, a function that allowed for an angle to be added and the robot would turn to the specific angle allowed for improved precision (which allowed for more poms to be gathered).
- This data clearly shows the importance of improved precision during tasks that involve collection game board pieces based off of predicted trajectories. Each time the precision was improved, be it more specific code or a build design change that interacted more with the game board, the points scored improved.
- Throughout the testing of this claw the design changed often, as did the code along with it. With the addition of the self aligning bumper scores jumped dramatically. further design changes might include improved claw sensitivity (so that the poms could more quickly be scooped up). In short, anything that relies more on the attributes of the game board than precoded trajectories.

Modified System Section

BEFORE	AFTER





The design change that is represented here is the addition of a self aligning bumper along the right side of the robot. This is in short a piece of lego protecting the right wheel with the intended purpose of improving the precision of the robot driving because it allows it to guide along the PVC pipe.

- This decision was made while watching test runs and noticing how the robot could not make the precise angle turn that was required for the pom collection trajectory. The robot continually could not make the required turn angle as the straight line would veer right, skewing the position. Rather than spend copious hours trying to fine tune a failing turn the team conferred and a more logical solution was made.
- This design had not only already been profusely tested but will be tested every time that the robot is run because pom collection is so important to the overall points scored. With this design working in tandem with the new turn by angle function the trajectory based pom collection has been vastly improved.