**Robot Design and Modifications**

Following the initial brainstorming and stages, we began work on constructing the robot and determining how to build the components based off of the task we had decided to complete. In order to complete the robot in the allotted time, we delegated the production of each part to a different group to work on. This allowed for multiple things to be in the development and construction cycle at the same (anywhere from 2-3 things), minimizing the amount of time it takes to fully construct the robot. Each team had a specific amount -of building objectives that were required to complete the component the components while functioning as an informal completion timeline.

| **Component** | **Purpose** | **Building Objectives** |
| --- | --- | --- |
| Chassis | House all of other components and possible modules. | -Measure and Assemble PVC Outline  -Attach wooden boards |
| Winch and Gate | Hoist up paint cans, and possibly stray water balls. | -Secure gate to chassis  -Erect atm posts to the PVC outline  -Insert crossbar between arms  -Attach drive motor  -Connect strings to the gate and drive motor |
| Drive Wheels | Allow the robot to move. | -Cut styrofoam and wooden circles  -Glue styrofoam and wood to each other  -Drill holes into wheels  -Attach wheels to drive Motors |
| Rotational Wheel | Allows the Robot to turn easily and provide more mobility. | -Connect Wheel to ball bearing spinner  -Attach to the front underside of the robot. |
| Firing Mechanism | Propel the water projectiles towards the No Entry Zone. | -Wooden Gear and Track  -Crank Servo and Pulling Mechanism  -Firing track/ Loading bay |

Robot Chassis

The first thing that was constructed was the chassis and was completed rather quickly based on the original blueprints with little to no problems. The original design was a PVC support frame with wood boards drilled to the edges allowing components and modules to be fixed onto. Some modifications were changed to the chassis to allow components to fit requiring the wood to be cut down and reshaped to create the necessary space. Another modification to the chassis was the inclusion of a secondary board under the main one as to mount the non-drive wheel used for turning. Additional wooden rectangles were added in order for the wheel to be attached in its proper location.

Winch/Drawbridge Mechanisms

The winch system drawbridge system itself went through two different iterations. The first of which was a drawbridge hoisted by two strings attached to pulleys that were affixed to an elevated rod. This bar was rotated using a gear track mounted onto the same bar as the pulleys and a motor fixed to the front board of the chassis which powered the system. After completion, the system was tweaked here and there to affix the strings to the proper length and ensure that it would work correctly.   
 Later on, the system was revised eliminating the pulleys and gear track mechanism opting for only the drive motor with the string attached and hoisted over the elevated rod and then connected to the gate similar to the last system. One of the reasons for the change is due to the lack of reliability of the previous design in the gear track system with its frequent track slips and slow lowering and raising of the gate.  
 Following the gates completion, we came to the realization that the game itself would not be able to effectively collect the cans and stay water balls without the addition of some sort of sweeping arms to keep the cans in place prompting the creation of sweeping arms to move the balls and cans onto the gate and keep them secured.

Movement

The robot is capable of movement with two wide drive wheels affixed to both sides of the base with a third wheel fixed underneath the robot capable of turning left and right in a swiveling fashion similar to the front wheels on most shopping carts or trolleys. Before the integration of a swivel wheel in the front of the robot, another alternative was to gave a PVC stub or elbow that would rub against the ground and function similar to the wheel wheel but was not used due to the amount of friction it would create and the decrease limited maneuverability compared to the other option.  
 When designing the main drive wheels we decided to use wheels with a large diameter with a decent width. While this would decrease our speed, it would, in turn, create much more torque, allowing the robot to traverse the field easier and make driving the robot simpler for the driver. In Order to achieve these two thin wooden circles were cut to the same specification while a third was made out of styrofoam and cut in the same fashion. Then all the styrofoam circle was glued between the two wooden ones and the circumference surrounded in grip tape to create traction and ten holes drilled equidistant from each other to reduce the weight and still provide enough structural support. This process was later repeated for the second wheel.

Firing Mechanism

When trying to come up with an effective firing mechanism, the team unanimously wanted to have an automatic loading mechanism but quickly eliminated the use of a hopper where the balls were fed in from the top because of the amount of unnecessary intricacy

Construction Problems and Challenges