1. **Design and Development**

1. ***Conceptual design***

***At the start of the season we went through several ideas to get to this final version . all of our designs start off on paper then move to cad to get the precise parts . A couple of early designs were a couple versions of a claw and later went to active intake . All of the designs were chosen strictly based on numbers as we believe that the numbers don't lie***

***b.*** ***Prototyping and Testing***

***One of the first ideas that struck us was a single claw mounted on an arm . We initially drew out then caded it and bought the parts necessary to build it . This idea was crucial for us to do as it let us know the flaw with the claw which was how precise we needed to be . Through the testing of this we came to our next design. It was an active intake with a grabber on a rack and pinion . After we went to this design we realized a couple of things . Since the pixels were on the ground they could likely get caught on something and we could lose them . The next one we went to was an intake into a single pixel box . This was a really well proven design used till lm1 but later changed to a two pixel box which was found to be very effective b.*** ***Prototyping and Testing***

***c.*** ***Modifications and Iterations***

***Through the designs we have been heavily iterating . We have about eight iterations of our two pixel box to make it as effective as possible . We have also modified our drone launcher and hang . We started out with just a rubber band to shoot the drone but soon realized that the power was not enough , so we finally ended up going to a slider to ensure there is equal and large amount of force on the drone . Secondly , our hang has gone through lots of iterations too we started out with a tape measure and realized that it got to wobbly at the top and so we switched to arm with magnets to ensure the hook stays on and then use a winch to pull***

**2.** **Analysis and Selecting the Preferred Design**

| Name | Time to pick up (from hp) | Pixels scored (Backdrop) 2:00 min |
| --- | --- | --- |
| Basic claw | 12 sec | 2 |
| Rack p claw | 8 sec | 3 |
| Single box | 4 sec | 7 |
| Double box | 2 sec | 9 |
| Final - | Double box | Chosen - most eff  icency |

**3.** **Detailed Design**

**For the design of the dual claw we sketched then caded it out .We made the box a little bigger than two pixels to allow for error . For the arm we used a motor and powered it through bevel gears to prevent excessive stress placed on the motor . We also used an extension powered by a linkage to allow us to reach higher. Through the addition of weight to the arm we faced a big issue . In our pidf loops we had to run a heavy amount of current . Due to this high amount we faced issues with the hub restarting . To counteract this we counter sprung the arm to make the arm like dead weight . To calculate the amount of tension needed we used a simple formula . We used hooke's law f=-kx to calculate .**

[**https://cad.onshape.com/documents/e2df1e251848d1c9a12e87cf/w/957c88f8fff3655d6907fbc8/e/9925aafd3e291e6bcf4b717c?renderMode=0&uiState=65a55210d282054fd4bbc8f0**](https://cad.onshape.com/documents/e2df1e251848d1c9a12e87cf/w/957c88f8fff3655d6907fbc8/e/9925aafd3e291e6bcf4b717c?renderMode=0&uiState=65a55210d282054fd4bbc8f0)

**4.** **Materials and Components**

For the materials we used a standard aluminum channel and aluminum extension seated on bearing guides . We used two servos on the arm . One for extension and another one for the wrist . For the extension we used a Gobilda torque servo and a speed servo for the bucket . The bucket was made from pla and used a high infill to keep it strong .