Project Name

2020 Ball Launcher

Group Name

The Three Miyigos

Logo (graphic)



Mission Statement

“Anything the Miyoshi Gang can do The Three Miyigos can do better”

Member Names

Logan Dice, Connor Haraden, and Ryan Fuglvog

**1.0 Introduction**

1.1 The Three Miyigos were asked by the Society of Cedarcrest Engineers (known as SCE) to create a contraption that launches a digital ball with a diameter of 3 inches. They are asking the Three Miyigos to include drawings of the Digital Ball Launcher (DBL), testing plans and results, scale models, and a digital assembly. The SCE asks that all digital assemblies are tested on December 01, 2020, all written proposals are due December 16, 2020, and that design teams submitting proposals for consideration will present their designs between January 06-22, 2020.

1.2.1 Logan Dice: Logan split up the parts among the group members and also helped decide on what parts should be made. He designed the first DBL and created the measurements for every part that would be used in the finished model. Logan created the wheel, the torsion-type spring, the gear stopper, and the drawings for each part. Logan also wrote a part of the requirements document.

1.2.2 Connor Haraden: Connor made the final assembly using the parts that he, Logan, and Ryan had made. He also made the drawing for the final assembly. Connor helped schedule meetings by consistently asking certain times that would work for everyone. Connor created the axel and the arm of the catapult as well as drawings for each. Connor wrote part of the requirements document.

1.2.3 Ryan Fuglvog: Ryan helped the group by acting as a leader and a guide. Ryan is the only member of the group with over a years' worth of experience in modeling using SolidWorks and he used this experience to help the other group members. He acted as a leader by making final decisions and sharing useful techniques to make modeling easier. Ryan made the base and the winch of the catapult and made the drawings for each part. Ryan also wrote part of the requirements document.

1.2.4 The Three Miyigos collectively put in about 18 hours and 45 minutes into this project.

**2.0 Design Features**

2.1 The contraption is designed to launch a ball with a diameter of three inches. The Three Miyigos created a catapult to do this task that is lever-operated. The user must manually reload this machine whenever it is fired.

**3.0** **Design Process**

3.1 The Three Miyigos’ first idea was to make a trebuchet. Which would be powered by a falling counterweight. However, the materials were too natural and there would be too much mechanical breakdowns.

3.1.2 The Three Miyigos’ second idea was to make a type of cannon where when a string was pulled it launched the 3-inch diameter ball. But the problem with that idea was there wasn’t enough parts that they could think off and they didn’t like the kinds of materials the cannon would have to use.

3.2 One problem that The Three Miyigos’ group faced was trying to make parts look natural. In addition, a big problem that the group had was making measurements for all the parts because, sometimes someone would have to change measurements on the part that they were making to either make it look better or to fix a problem in the measurements they were given. Since this was happening the other people in the group would have to change the measurements on their part so they could match the other person's part. This problem was fixed by meeting as a group on discord and sharing each other's screen to show changes and communicating what to do. Also, they realized that they needed to make a gear stopper and a gear on the torsion type spring in order to help create tension in the rope to make the catapult launch foreword.

3.3 None of the angles in The Three Miyigos’ catapult were created using math. They at first just randomly selected an angle they thought would work as a group and luckily the angle they chose worked out on the first try.

**4.0** **Description of Parts**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Part Number | Description | Materials | Manufacturing |
| 4.1 | AAA-001 (replace the AAA with your own designation. You could use the last initial of each group member. | Describe what each part is. Give enough detail so that people can visualize it to some extent. Use the table->insert->rows below menu item to add as many rows as you have parts. | Tell of what material(s) the part is composed. Give part number, description, materials, manufacturing info for each part. | Tell how the part is made. If it is made by another company, give the company name and their part number. |
| 4.2 | LRH-001 | This is the base of the catapult it holds all of the pieces together its structure consists of a 18 by 11 inch rectangle with a cross bar raised by two posts. Supported with two angular pieces on each side | This is part 1, the most important part of the catapult made fully out of wood. | The base being completely comprised of wood makes it relatively cheap and easy to manufacture. The loose pieces are attached to the bottom rectangle with wood glue |
|  | LRH-002 | This is the axle; which holds the wheels in place it is put into the holes located in the front and the back of the base. | This is part 2,  They are also made solely out of wood there are two of them, each will house two wheels. | The axels are very simple to make, cylindrical pieces of wood very easy to acquire and create. |
|  | LRH-003 | This is the wheel; which has a basic wheel design. There are four wheels on the catapult, two in the front two in the back. | This is part 3,  The wheels are made out of wood and are small in size | The wheels are easily manufactured a wood cylinder with a hole the size of , four wheels one for each side of the axel. |
|  | LRH-004 | This is the torsion-type-spring; it is located slightly behind the crossbar. It builds tension used to throw the object it also has a gear on the side used in conjunction with the winch and the gear stopper. | This is part 4,  The torsion-type-spring. It has multiple different materials used in the part including brass wood and a rubber band | When being manufactured we had to order brass to cut out a gear attached to the outside of the part, as well as a large rubber band to build tension wrapped around the cylindrical wood piece used to hold the arm |
|  | LRH-005 | This is the arm; it holds the ball that the catapult flings, it is attached to the torsion-type-spring causing the arm to move and the object to be launched | This is part 5,  The arm has two different materials in it that being wood and brass | Unlike the crude brass the arm has a small brass hook purchased separately which was connected to the wood arm |
|  | LRH-006 | This is the winch; it pulls back the arm which builds tension in the torsion-type-spring creating potential energy | This is part 6,  The winch is mostly comprised of wood but does contain a few brass components | The winch was cut mostly out of wood having a few more detailed portions that took longer to cut. then two brass pieces were inserted on either side in the middle to keep the winch stable against the base. |
|  | LRH-007 | This is the gear stopper; it holds the gear on the torsion-type-spring which | This is part 7,  The gear stopper is made out of brass but is overall quite small | The gear stoper was made with the left-over brass used to make the gear on the torsion-type-spring and required very little time to make |

**5.0 Assembly**

5.1 LRH-001 which is the base of the catapult has two small holes on the front and back of it. These two holes go through the whole catapult and LRH-002 goes into both of the holes.

LRH-003 is supposed to go on the axels. LRH-003 goes on each end of the axels and it will fit perfectly.

For LRH-004 there will be a hole that is close to a cross bar that goes all the way through the catapult, the torsion type spring goes in there.

LRH-005 has to be on LRH-004. To do this there is a hole at the bottom of LRH-005 and that hole goes around LRH-004. LRH-005 then is slid to the middle of LRH-004 and is attached.

At the back of LRH-001 there is a trapezoid part that has a hole all the way through it. LRH-006 is supposed to go in there. After LRH-006 is put through the hole, spacers are added on each end of the trapezoid and on both sides of LRH-006 so that it can’t move.

LRH-007 is right next to LRH-004. So, there is a hole right next to where the gear part of LRH-004 is and LRH-004 is put in that hole and is turned so that it is in the gear on LRH-004.

**6.0** **Operation of Equipment**

6.1 A rope is tied to the winch and then is tied to the hook on the catapult arm. Then after the rope is attached, turn the winch which will pull the catapult arm down. As the arm is being pulled down tension will build up because the rope is being wrapped around the winch and the arm can’t move forward because of the gear stopper. The gear stopper is stopping the torsion type spring from moving forward so tension builds from the torsion type spring because the rope wraps around the winch tightly. After the arm is pulled all the way down you put the 3inch ball in the basket of the arm. When someone wants to launch the ball pull the gear stopper away and then the tension will release and launch the arm foreword which launches the 3inch ball.

**7.0 Cost Accounting**

7.1 How much did it cost overall?

When taking into account all of the cost including work hours, and materials. The hours cost a total of 937.50$ with each person getting an equitable amount of 312.50$. the materials on the other hand, were much cheaper only costing 208$. All in all the project costed a total of: 1145.50$

7.2 How much time was spent doing different tasks:

Planning: 1 hour 15 minutes

Designing - 4 hours

Building - 5 hours

Writing - 8 hours 30 minutes

**Appendix A** (Tests)

# Test 1

**Purpose/Problem**: Create a contraption that can launch a ball with a diameter of 3 inches.

**Hypothesis**: The Three Miyigos can expect the ball to be launched.

**Procedures**: Step 1: Someone sets the torsion-type spring .

Step 2: Someone attaches the hook to the arm and sets the winch (pulling back the arm).

Step 3: Someone places the ball inside of the basket.

Step 4: Someone pulls the lever, releasing all of the tension and launching the ball.

Step 5: Repeat steps 1-4 as many times as needed.

**Appendix B** (Accounting)

Give details of cost of parts. Price each part individually and give the total cost as well.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Part Number | Description | Cost |
| 4.1 | AAA-001 (replace the AAA with your own designation. You could use the last initial of each group member. | Describe what each part is. Give enough detail so that people can visualize it to some extent. ***Just copy the table in section 4, delete the last column, and change the next column to Cost (instead of materials).*** | Give the cost of materials. If not new, give approximations for new materials as if actually purchased. |
|  | LRH-001 | INFO GIVEN IN SECTION 4 | This part was Mostly wood making this part relatively cheap, but because of its size and amount of extra needed to be cut the price was set at 50$ |
|  | LRH-002 |  | This part was extremely cheap because it was just a wood shaft only costing 10$ for the two shafts |
|  | LRH-003 |  | The wheels were mostly wood but had a bit of metal as well, because there was four wheels their total price was around 47.40$ |
|  | LRH-004 |  | the torsion-type-spring being a more complicated part had metal wood and a large rubber band, its total price set at 60$ |
|  | LRH-005 |  | The arm was almost entirely wood except for a hook attached near the head of the arm this brought the price to a total of 22.60$ |
|  | LRH-006 |  | The winch was also completely made out of wood which dropped the price down to 15$ |
|  | LRH-007 |  | This part being so small cost close to nothing only totaling to 3$ |
| Total |  |  | The total cost of all the parts was 208$ |

Log of labor hours for each group member (including design, and class time used) and determine the labor cost for each member (and task) as well as the total labor cost.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Task | Time spent (hours) | Rate ($/hr) | Cost |
| Group Member 1 Name | Describe general task done. If a group member does a different task at a different rate, use another line. | Give time spent (hours to nearest 10th). Include class time spent on project. | Hourly wage. Give rationale for wage below. | Multiply hours times rate. |
| Group Member 1  Ryan F | Worked on LRH-001 and 006 acting as a sort of group helper helping the other two with any possible problems and worked on the Rq-doc | 6.25hrs | 50$/hr | 312.5$ |
| Group Member 2  Logan D | Worked on LRH-003, 004 and 007 built any of the extra parts that we might needed and worked on the Rq-doc | 6.25hrs | 50$/hr | 312.5$ |
| Group Member 3  Connor H | Worked on LRH-002 and 005  He also helped put together the assembly and worked on the Rq-doc | 6.25hrs | 50$/hr | 312.5$ |
| Total Labor |  | 18.75hrs |  | 937.5$ |

Cost of labor (Hours of labor \* rate) Give rationale for rate selection (i.e. what skill level does each person possess?)

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Task | Rate ($/hr) | Rationale |
| Group member 1 name | Give a description of the task. | Hourly wage. | Give rationale for the rate given. Experience, expertise, etc. are reasons to give wages above the minimum wage. |
| Group Member 1  Ryan F | Worked on LRH-001 and 006 acting as a sort of group helper helping the other two with any possible problems and worked on the Rq-doc | Same as above | We decided to have give each person the same wage as we felt each person gave a equitable amount of effort and each person brought a different form of expertise to the table. With the tasks given that is mostly what we based the expertise on. |
| Group Member 2  Logan D | Worked on LRH-003, 004 and 007 built any of the extra parts that we might needed and worked on the Rq-doc | Same as above |  |
| Group Member 3  Connor H | Worked on LRH-002 and 005  He also helped put together the assembly and worked on the Rq-doc | Same as above |  |
|  |  |  |  |

**Appendix C** (Computations)

Calculations of physical properties necessary to accomplish task.