AUTODESK® INVENTOR®

RoboPower 36637A

Make It Real CAD Engineering Challenge

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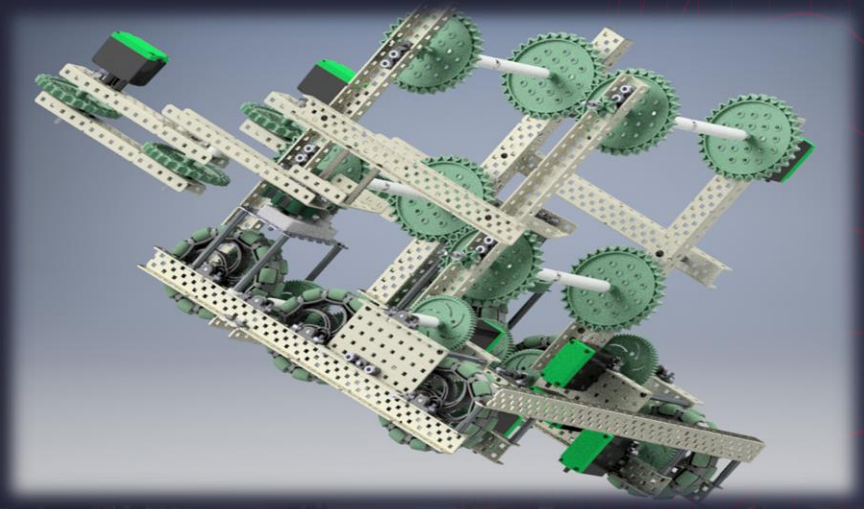
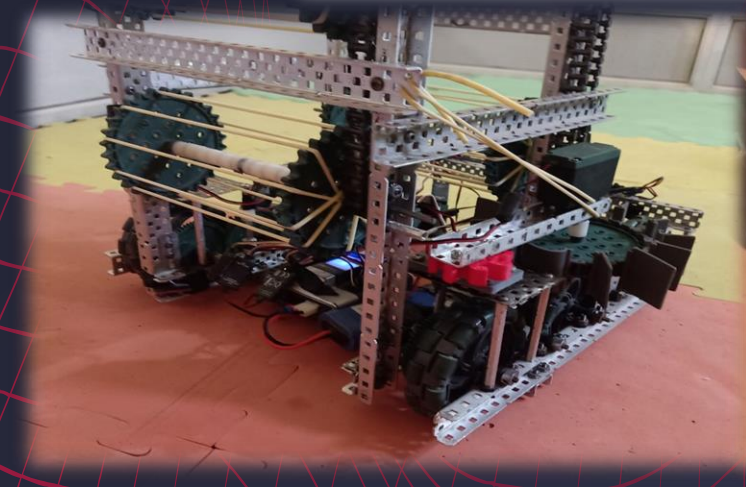
Introduction:-

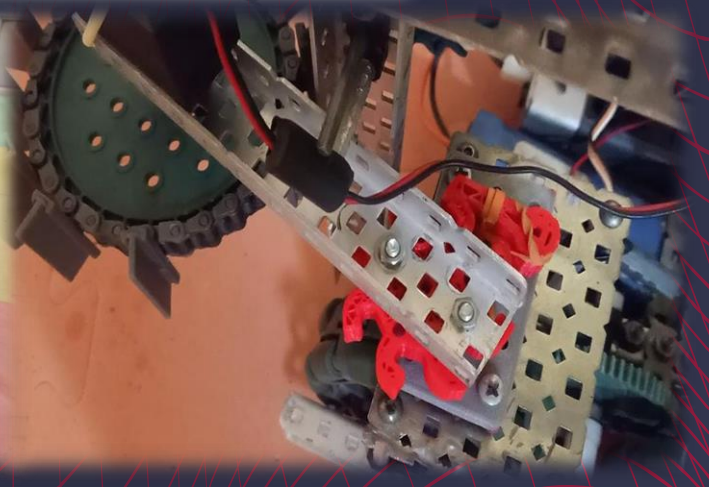
The problem began to appear in Tower Takeover 2019/2020 Mission in VEX Robotics Competition. Our robot had a manipulator, which was collecting the cubes from the field. Manipulators mechanism had to be inside the dimensions due to the limitation of robot dimensions at the competition. At the beginning of the match, the manipulator opens until it became in the front of the robot, using the Rubber bands.

Last Year, while working on the Tower Takeover challenge, we faced a problem in the manipulator mechanism which was responsible for collecting cubes. The manipulator should be bent to the back at the beginning of the match in order to keep it inside the dimensions of the robot, and it was pulled by the rubber bands. Sometimes the rubber bands cut off. Thus, it made the manipulator has not a free movement. So, We designed a new part (Back Lock) to solve this problem.

The idea of the Back Lock is similar to the idea of making a non-return mechanism. When the mechanism of the manipulators opened, the new part lock itself. Thus, it will be assembled well to the robot and helped us in the Mission of Change Up 2020/2021



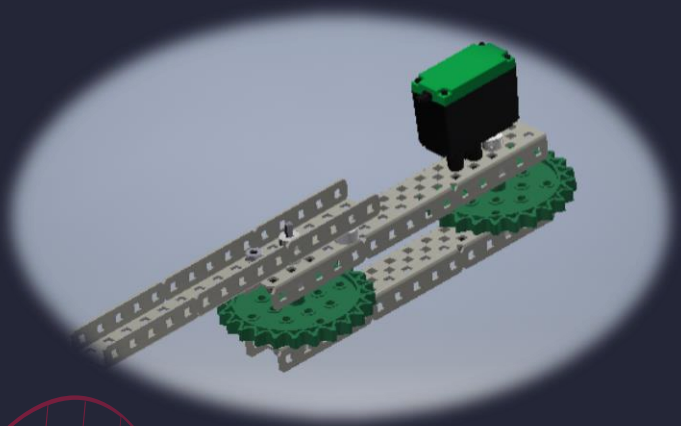


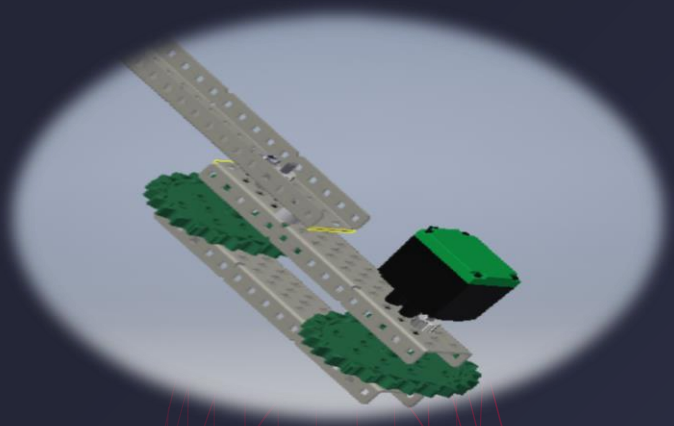


Functionality :-

The function of the new part is to solve the problem of the Manipulators Mechanism which is that when the robot starts on the match, this mechanism will be both sides of the robot's manipulator. This is not to violate the robot's dimensions at the beginning of the match.

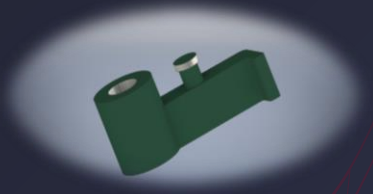
The function could reached by assembled the following parts to perform the required task.

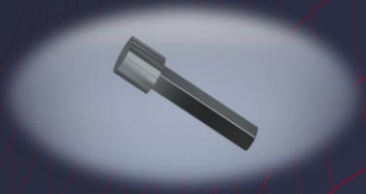


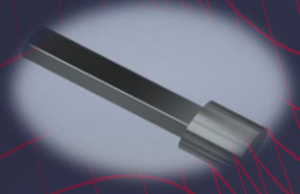


-Design:

The idea of designing the new part came to our minds after facing that challenge and seeing more than one team facing the same problem. So, we solved that problem by designing the new part on the Autodesk Inventor Professional 2018 software. After designing each part, we assembled them together to make all the parts drawn working effectively. The new design consists of 6 parts grouped together:





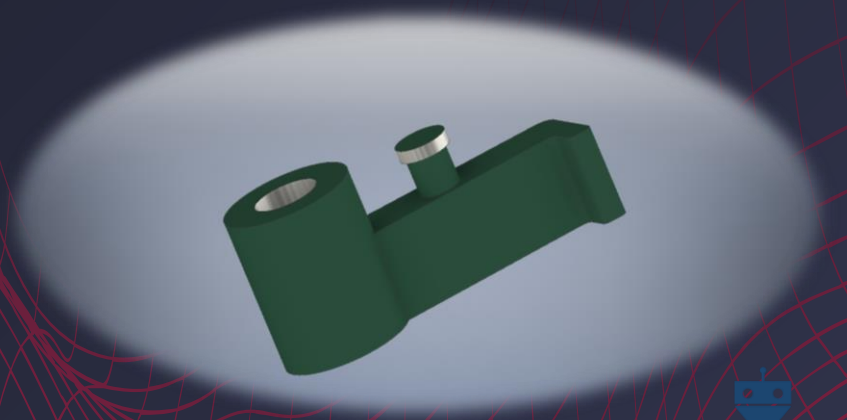


1- Gear:-

The gear is designed with 8 teeth, but the gear teeth are designed differently from any other gear found in VEX. They are designed to look like the shape of an arm. So, when the gear rotates in the direction with which the arm travels or when the gear rotates in the other direction, the arm rotates in the opposite direction of the gear. The arm goes between the gear teeth and stops the movement.

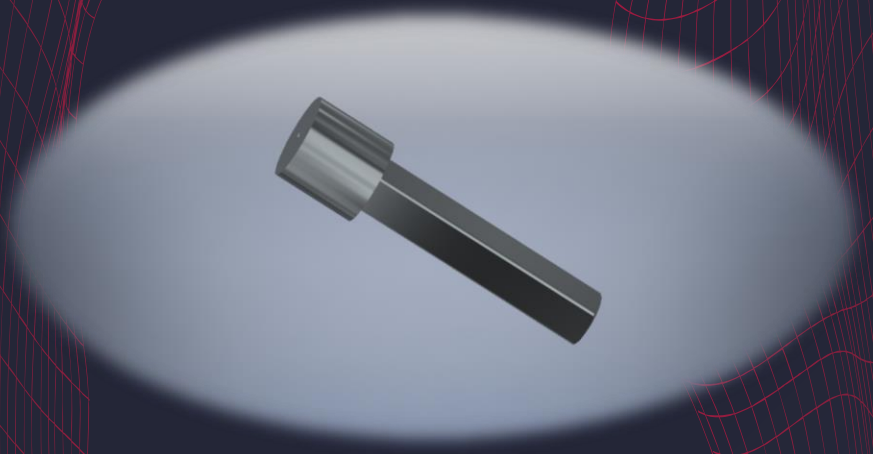
2- Arm:-

The arm is designed based on the shape of the gear teeth in order to **not** cause any problems during the movement with the gear in the same direction. When the gear is moving in the other direction, the design of the arm works to enter the arm between the teeth of the gears and hinders its movement. So, it does not make it able to rotate in the other direction, and the arm is fixed by a Rubber band in the base to prevent the gear from escaping its place.



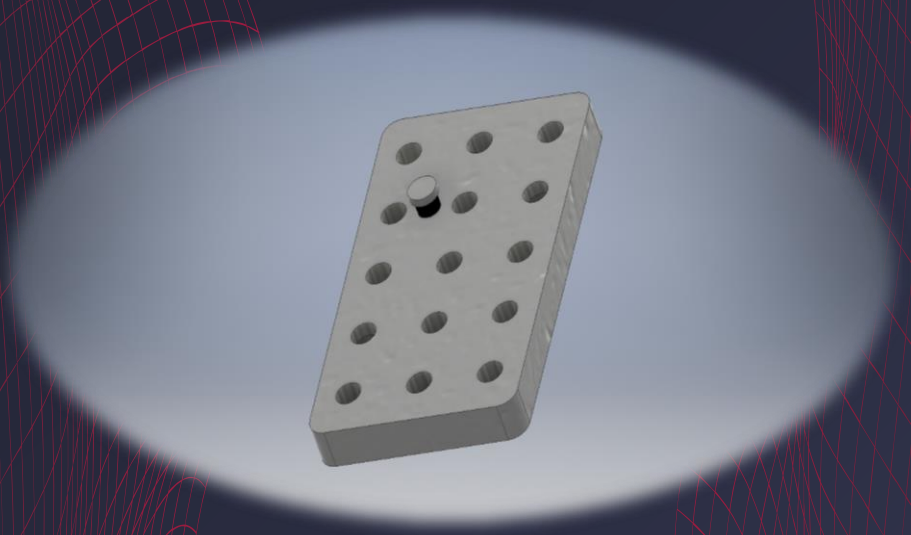
3- Shaft:-

Two shafts are designed, and their function is working where one shaft is placed inside the gear and is fixed to the base. Thus, it cannot exit the gear during the operation and the other shaft is placed inside the arm and is also fixed in the base so that it is tight during the movement.



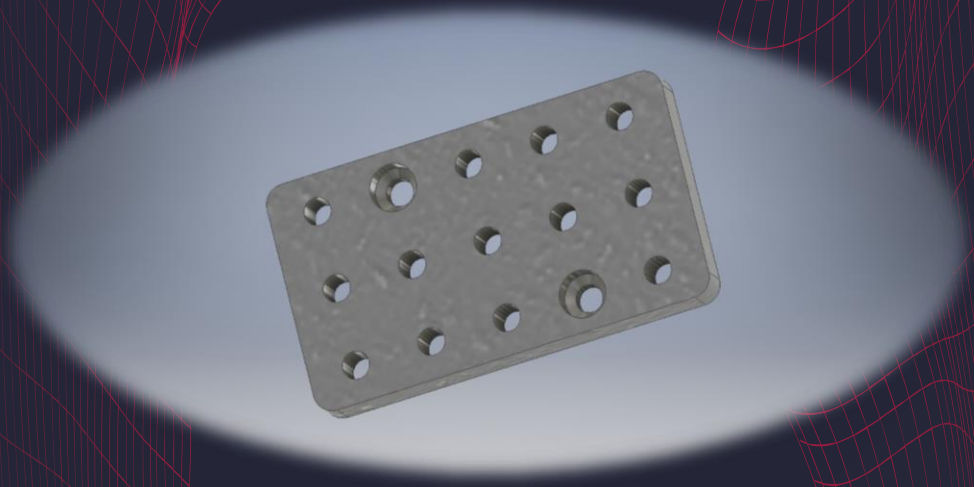
4- Base 1:-

The base is designed to make both the gear and the arm fixed on it. The base is designed with holes on the surface of the base to install the columns and the other holes to fix the screws between them and the mechanism. There is on the surface of the base 1 prominent part of the surface, so we can tighten the rubber band between it and the arm to make the mechanism performs well.

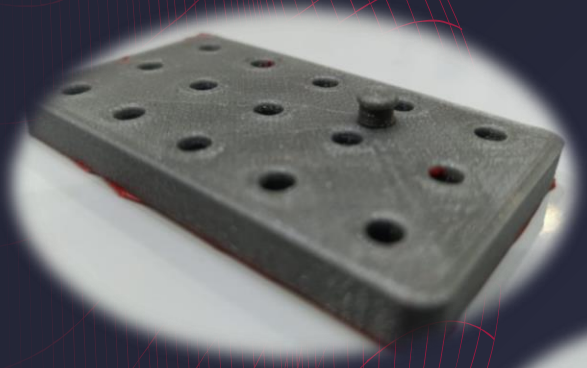


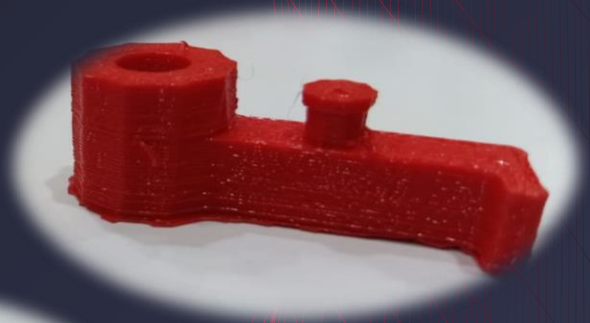
4- Base 2:-

Base 2 is designed with the same design as Base 1 and is placed behind Base 1. When shafts are placed into Base 1, the mission of Base 2 is that it locks on the shafts in order to prevent them from leaving Base 1 and until it is well fixed.



And after thinking about the design for each part and drawing them. We made an assembly for all the parts. Then, we printed each part using the multi-maker 3D Printer. After that, we collected them together and to be installed as a back lock mechanism. Finally, we installed it on the robot and made the test of the prototype.

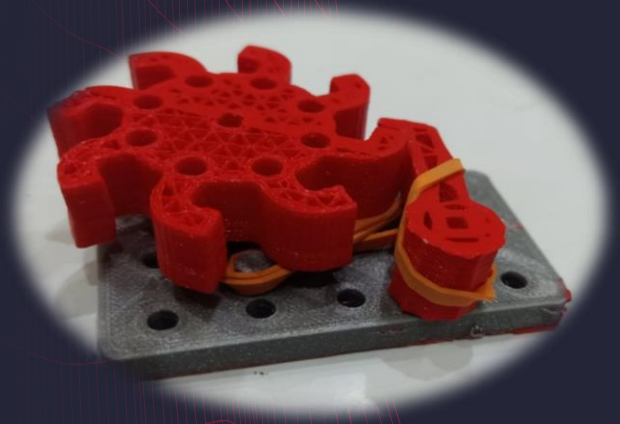




How Inventor was used?

Software version used: Autodesk inventor professional 2018. At the beginning of the project, we developed ourselves in CAD software and trained a lot on the Autodesk Inventor Professional 2018 program. Then, we started working on the project by making a brain storming for the problems and needs in our work and thinking of ways to solve them. When the idea of the new part was reached, we started drawing more than one part and modifying them.

Until the last of the aforementioned parts were reached, the assembly was made for all the parts. After which a simulation of the part was made until it was an animation, the file format was converted into **STL** format so that we could print it on 3D Printer.



Conclusion

What We Have Learned?

Through this challenge, we learned a lot of skills like critical thinking and mechanisms discovery. And by drawing many parts and modifying them after many problems appeared, we gained many technical and engineering design concepts on assembling the project, implementing simulations, making animations, and discovering skills when printing parts.

We benefited from the project as well, that we are in an industrial school, in our projects through applying STEM methodology.

Certainly, we will use all what we have learned in the future, and we will benefit from them in our professional life. If you ask us for our feeling, we will response by a good experience.