

# Evaluation of improving parts for a gripper

Mechanical Engineering

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## Abstract

This paper discusses the problems of building a stable and light gripper and presents a new gripper kit that could solve this problem. In the first main section grippers in general are analysed and the problems with the Botball parts are pointed out. The second main section outlines a new set of parts to build a well working gripper very easily. The set has been developed by the Team Scorp Robotics and the parts are 3D printed.

## 1. Introduction

The international education robotics program “Botball” encourages young students in Middle and High schools to build their own robot. The teams, which mostly consist of 4 team members, do not only have to build the robot but also to write their own program.

Moreover, the documentation of the building and programming process is a major part at Botball which should help the participants to get used to research project structure. When it comes to building a gripper it is often very complex to find the right parts in the Botball set. Furthermore it is very complicated to locate the gripper on the robot. In most cases building such complex grippers is necessary due to a lack of parts in the Botball set.

In the second part of this paper the idea of the new gripper is presented.

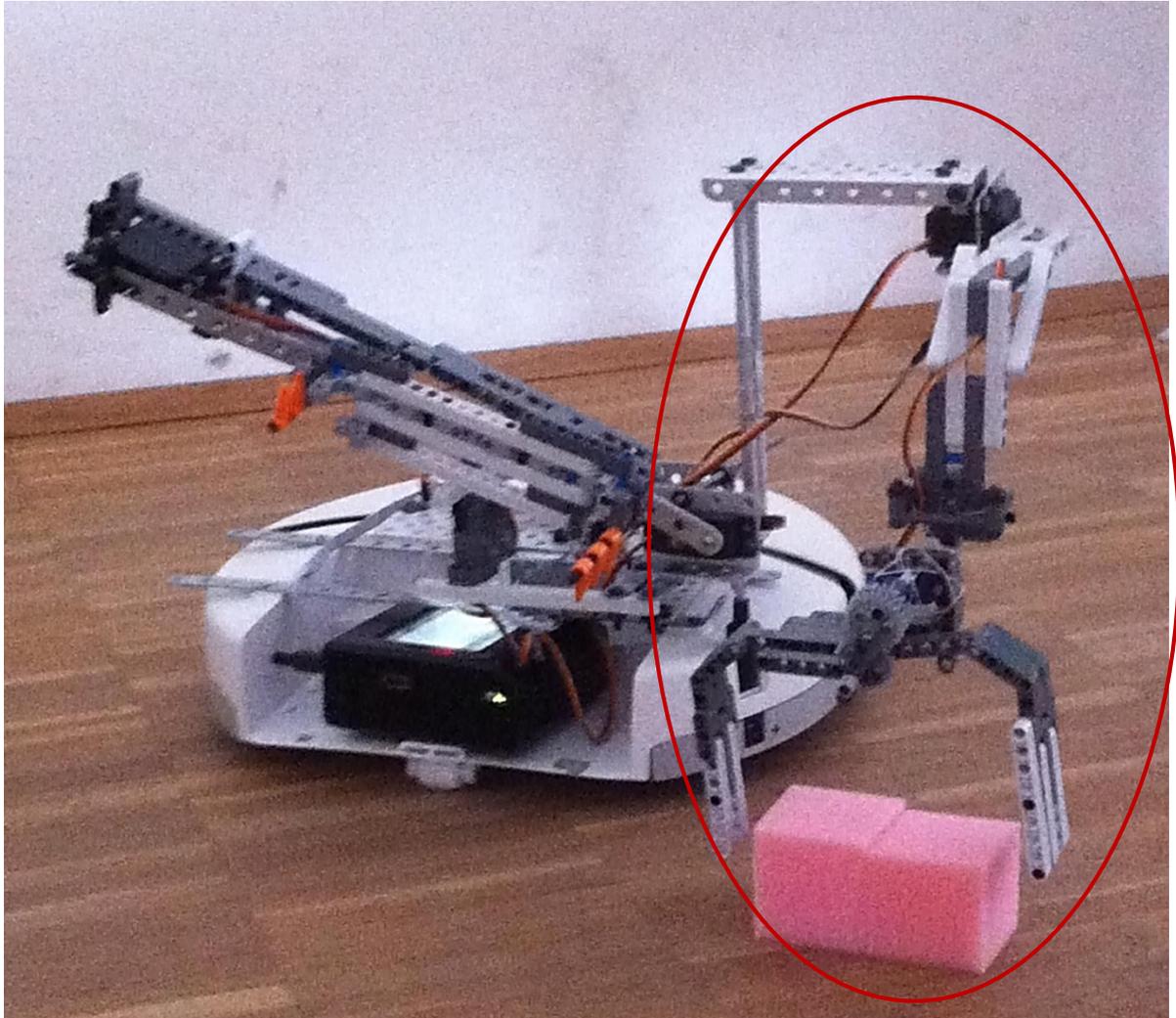
## 2. Concept/Design

In general it is not very complicated to build a simple gripper but to build a gripper which works well is rather complicated with the Botball parts. Especially if the gripper should achieve a task that is needed for high scoring. A stable one is very heavy but a light gripper is not very solid in most cases.

### 2.1 The 2015 Gripper

Last year the construction of team Scorp robotics for a gripper was quite complicated due to a high number of parts that had to be used. For example we had to use three Gear-wheels but only one side of the gripper was moveable. However, the construction was really heavy and only the small servo could be used. If the big one had been used the other servos would not have been able to lift the full construction. Although already two servos were used to lift the whole constructions in two steps, it was still very difficult for the servos to deal with the heavy gripper. The next problem was that the small servo did not have enough power to grip Botguy and to keep it. That is why the construction was not really reliable and that was a rather big problem. As lifting and holding Botguy resulted in getting a lot of points and so it depended on starting at the "right" side of the table because opposite of Botguy there was a green cube which was much lighter and easier to grab. As already mentioned before only one side of the gripper was moveable which made it quite complicated to put the robot in the right place so that the object could be gripped. If the robot was misplaced in the way that the fixed part of the gripper was further away from the object it was no problem because then the object was pushed with the moveable part in the gripper so that it could be taken. But the other way round was the worst case scenario because then it was not even able to snatch the lightest objects. In order to make the other side of the gripper articulated as well a second servo could be used on the one hand or on the other hand a very complex construction of Gear – wheels to make both sides flexible could have been built. But that would have caused a lot of extra weight and that is the reason why it was simply impossible to make both sides moveable. That is because one of these two

possibilities had been built, the other servos could not lift the gripper any longer. This gripper can be seen in picture 1.



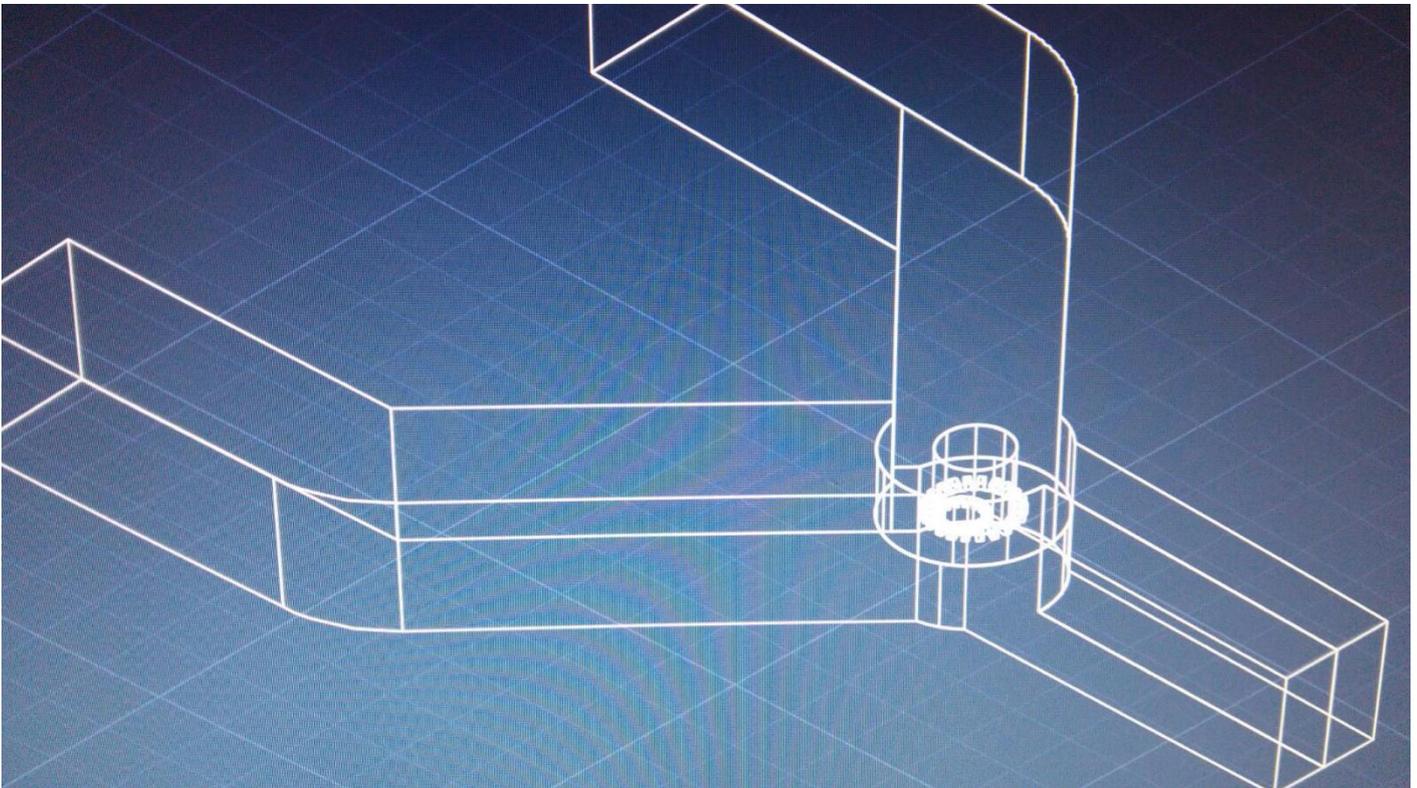
Picture 1

## 2.2 New Set for Grippers

Because it is so hard to build a reasonable gripper the idea of a new set for grippers in the next Botball set for 2017 came up.

Basically the set consists of three parts that are really needed for this gripper which makes it really easy for future teams to build a well working gripper. One part is of course a Gear – wheel to transmit the power of a motor or servo to the gripper. That

Gear – wheel is placed where the two portable parts of the gripper coalesce. On the two flexible parts of the gripper is one Gear – wheel placed on one side as well. With that simple construction both sides are mobile. The motor or sensor can simply be placed under or behind the gripper dependent to the orientation of the gripper. If the gripper is placed to grab objects upright the motor or servo has to be placed behind the gripper. On the other side if the gripper is used to clutch the objects horizontal the motor or servo must be placed under the gripper. Of course there is no universal solution for grabbing objects. Therefore a set of 4 or 5 grippers for the basic gripping forms could be built. This paper is only discussing on type of these grippers. This construction could be seen in picture 2.



Picture 2

### 3. Implementation

The production of the new parts is based on 3D – printing. As the material of the gripper can be changed easily addicted to the requirements to the gripper. If the gripper must be very light, a material, which is very light for example polyamide synthetics could be used. If the gripper must be very stable because it must grab

heavy things materials with carbon fibre could be used. This material is quite heavy but nevertheless lighter than the old constructions.

The second big advantage is that if desired a box where the whole gripper and servo or motor is placed can be printed. Then it is easier to erect the gripper on the robot and it is not need to build a build a heavy construction just to place the gripper on the robot.

To reduce the costs for each team KIPR should print out the parts. The costs for a 3D – printer are too high for some teams and so the costs could be reduced. So KIPR could print grippers of different materials and then sell every team the gripper they want. If a bigger school like the HTL Hollabrunn has already a 3D – printer then the grippers could be printed on their own. The materials which are allowed to use must be defined exactly.

Of course these grippers must be compatible with the Lego and metal parts that are already used in the Botball set.

## 4. Conclusion

This paper is discussing how complicated it is to build a well working gripper with the parts of the Botball set for 2016 and how this problem could be solved in the future. The experience made with building complex constructions is very subjective and maybe some teams enjoyed it to think about how they can improve their gripper. But one should always keep in mind that the main target of Botball is to score points really reliable if the target is to win. The idea on the new set for the gripper is only a suggestion how the Botball set for the next year could be improved. The authors hope that you think about this new idea and would be very pleased if they see their gripper set in the 2017/18 kit for Botball.