The "KISS" Motto Applied to Mechanical Design
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1 Keep It Simple Stupid

Simplicity, especially in the Botball competition [1], is the key to success. The simplest strategies combined with a simple robot design have proved to produce great results. Even Leonardo Da Vinci and Einstein, possessing two of the most complicated minds in history, believed the simplest solution was the best solution. [2] A robot with a simple strategy is easy to build, and a robot that is easily built can be easily fixed.

2 Lessons Learned as a Freshman

Everyone has been there. Freshman year was a learning experience for many. The first few meetings in the fall had shown that I was less than capable of programing a tape-following robot. I could make the motors drive the wheels on the robot, but never in the direction I wanted. A quick switch over to the Mechanical division of the team would develop my perception of simplicity for the better.

2.1 A Pinwheel Problem

Ambition tends to cause over complication which leads to catastrophic mechanical failure. I had too much ambition as a freshman. The 2009 Botball game board in Figure 1 included pinwheels made of pencils and paper as shown in Figure 2. My team had started work on a launcher that would shot the pinwheel onto the scoring area; however, the building of the launcher had run into a snag. I immediately volunteered to work on the launcher. Within twenty minutes, I had applied my first dose of negative work on the team, for the pinwheel launcher now had no hopes of recovering. From then until the senior who worked on the launcher graduated, I was the bearer of the "curse." The curse ironically jump started my simplistic thinking to help my team push on through further endeavors.

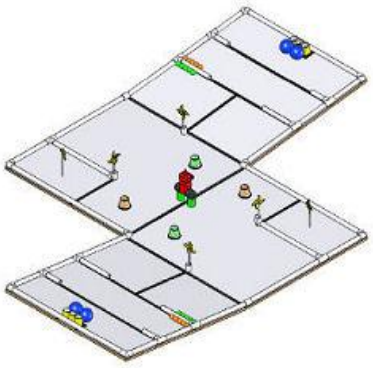

Figure 1: 2009 Botball game board.

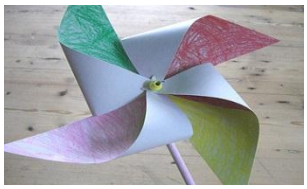

Figure 2: Pinwheel used in 2009 Botball competition.

2.2 Waiting

Waiting cannot be simpler. No special set of skills is needed to wait. The 2009 Botball game board (Fig. 2) had an open area in the middle where most of the game pieces were located. The ICreate Roomba [3] was too often crashing into my team's other robot. I suggested that the ICreate wait, but wait until an established point after the beginning of the round to make certain the CBC was clear from the area. The simple waiting brought my team to the very top of the standing for that year.

3 The Wise Fool

For the 2010 Botball competition, shown in Figure 3, yellow rubber ducks needs to be moved from an area surrounded by PVC Pipe. Many teams had constructed a complex claw system to remove many of the yellow ducks, but my team used a simple robot with simple designs.

3.1 The Simplest Robot

Our drop-down plow (Fig. 4) was lowered behind the ducks and pulled the ducks over the pipe. The ICreate then spun in a counter-clockwise rotation to align the ducks in a perfect line using a funnel (Fig. 5). Another innovative feature the ICreate had was the bent metal piece (Fig 6) attached to the front of it. The problem of the ICreate not being able to jump PVC Pipe was addressed and fixed through the use of one bent metal piece. The final simple addition to the ICreate was the cargo bay (Fig 7) made of random Lego pieces placed together to make a wall. The ICreate's basic motions were driving backwards, forwards, and rotating; however, the other robot, named "Ipad" at the time, did not follow the "KISS" motto.

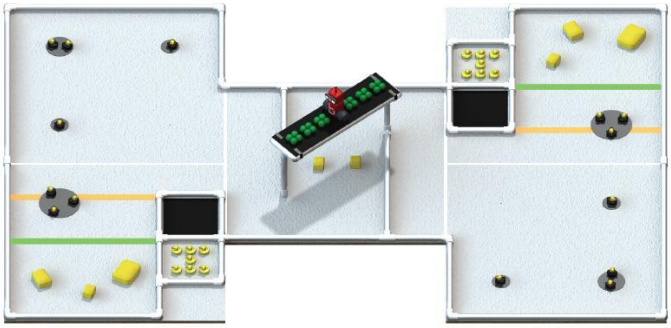

Figure 3: 2010 Botball game board.

Figure 4: ICreate's drop-down plow

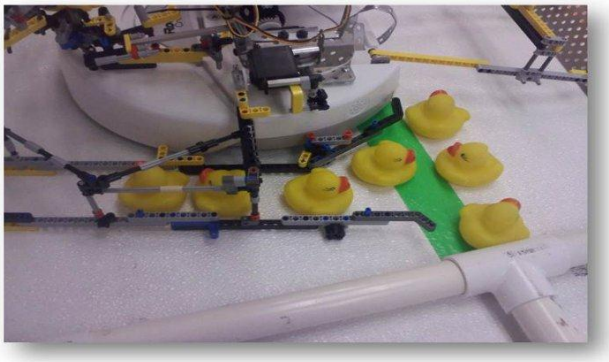

Figure 5: ICreate's funnel

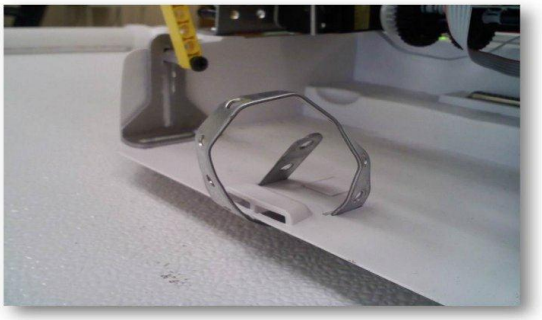

Figure 6: ICreate's bent metal piece.

Figure 7: ICreate's cargo bay.

3.2 Another Example of Why Simple is Best

Although ICreate's simple motion scored points, Ipad's complex strategy ultimately lead it on a path of scoring two or three points. The simplistic genius used on the ICreate was balanced out by the horrendous showing Ipad had. The Ipad used a piston (Fig. 8) to gather black ducks, but never succeeded. The only real use Ipad had was to take up more than half of the board.

Figure 8: Ipad's piston.

4 Escalator to Bucket

Many complicated ideas seem to be very good ideas in theory, but most of these complicated ideas do not work in practice. In order to lift biofuels into the Biofuel Container, my team came to the consensus to build and rotating Lego escalator. After a month of building and tweaking, the escalator idea was thrown out because my team could not build it. My team then built a bucket that could be open and closed. The bucket turned out to be a much better idea, for it won my team Second Place Overall for the Regional Tournament [4] and won a mechanical design award. The judges at the Regional Tournament solidified the "KISS" motto because the award was a statement about the simplicity and reliability of the bucket.

5 Murphy's Law

One cannot talk about simplicity and complexion and ignore Murphy's Law [5]. Murphy's Law states, "Anything that can go wrong, will go wrong." By adding complexion to robots, one adds more ways disaster can strike. Simplifying the mechanical design of a robot can limit the number of catastrophes in the PIT and at the Tournament Tables. If something does go wrong, the simpler robot will be easier to fix.

6 Conclusion

The "KISS" motto has seemed to produce the most success during my Botball experience.

References

[1] KIPR. Botball robotics education. http://www.botball.org, 2002.

[2] Wikipedia, the free encyclopedia. http://en.wikipedia.org/wiki/KISS_principle.

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[5] Murphy Laws Site- The origin and laws of Murphy. Murphy Laws Site- Origin. http://www.murphys-laws.com/murphy/murphy-true.html.