A Simple Interface between Conventional R/C Servos and the VEX Robotics System
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1. Abstract

The VEX Robotics System has taken a prominent place in robotics education due to its structural flexibility, ease of use, and relative low cost compared to custom robotics equipment. One drawback, however, is the fact that VEX motors and servos are custom made for the system, are typically expensive, and are rarely interchangeable with other controllers. Conversely, servos made for radio control applications are standard in form, relatively inexpensive, comparable in power with a VEX motor, and work with virtually all education-level controller, including the Botball XBC and CBC. Our goals are to develop a simple method for adapting a standard R/C servo to fit both VEX beams and axles to power robotic applications such as grippers, arms, and wheels, as well as to come up with a mounting system to mount the body of the servo to the robot.

2. Methods

Servo Body Attachment

Vex components are manufactured with square holes on a ½ inch pitch. This is key to their interchangeability with other VEX parts. We have found that it is possible to mount a standard servo rigidly to a VEX beam. The mounting holes of the Servo are spaced 2.4 inches apart, which is very close to lining up with 5 VEX holes (Fig 1.) The servo body itself is also 1 inch high from the back of the servo to the mounting flanges, which is a perfect size to use a 1 inch VEX standoff (Fig. 2.) It is advisable to keep the bolts loose to get the holes to line up and then tightening them. There is a small amount of lateral adjustment (~0.1

Figure 1- Servo mounting holes almost match 2.5" VEX spacing.

inch) that may be used for fine-tuning. Additional mounting options can be developed using the ¼ inch pitch metal kit, which is a specialized VEX part. Figure 3 shows final mounting.

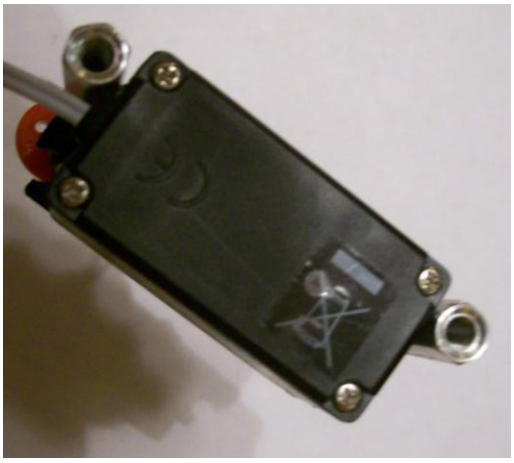

Figure 2- 1" VEX standoffs mounted to R/C servo body.

Figure 3- Final mounting. Note slight angle of standoffs to adjust for spacing alignment.

Motorized Axle Attachment

A major application for motors in robotics is motorized wheels. Wheels that are typically supplied with a kit are made to fit on axles, which is a difficult application for an R/C servo as they are made to control model avionics applications such as pushing and pulling control surfaces. The standard method used in Botball in years past centered on screwing a LEGO Gear to the servo horn, and then attaching the wheel to an axle attached to the gear. This method of adapting VEX parts is similar, but more robust and less prone to wobbling.

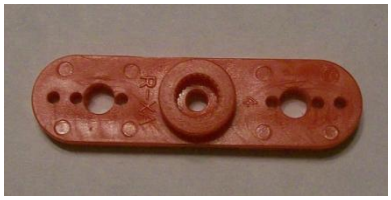

Figure 5- 5/32" holes drilled for VEX screws.

Figure 4- Servo horn/lock bar alignment.

The procedure begins by utilizing the large red "X" servo horn that is usually installed on the servo from the manufacturer. Two of the arms of the servo horn are removed, and the resulting piece is drilled to fit a VEX axle lock bar with a 5/32 drill bit (Fig 4.) The third hole from the end of each servo horn arm lines up precisely with the holes in the lock bar (Fig 5.) A metal lock bar was used in this method, but a

Figure 6- Rear collar, spacers.

Figure 7- Lock bar to prevent axle rotation.

Figure 8- Nuts, axle, and front collar.

standard plastic one may be used with a corresponding increase in flexibility. Axle collars were placed both behind and in front of the lock bar, and the assembly was bolted to the servo horn (Figs 6, 7, 8.) The axle is now rigidly connected, ready to attach wheels, gears, or sprockets from the VEX system.

Beam Attachment

Since the holes in the above method are 1 inch apart to fit the lock bar, they are also the same spacing to fit any other VEX part with that hole spacing. 1 inch corresponds to the distance between two holes with one between (Fig 9.)

Figure 9- VEX beam attachment.

3. Testing

An omnidirectional robot was constructed using the mounting methods and is the subject of another paper. Performance was no different from using VEX motors (Fig. 10.)

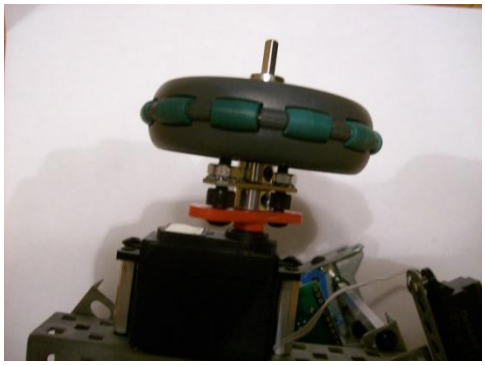

Figure 10- VEX omnidirectional wheel mounting on robot.

4. Conclusion

It has been shown through testing of various applications that our method of adapting standard R/C servos to VEX hardware is a viable way to increase the flexibility of the system. Many schools have XBC and CBC controllers that can now be used with existing servos to take advantage of the structural robustness of the VEX system and the programming and control familiarity of Botball controllers.