Attachments and Sensor Mounting

Overview

- What is an attachment?
- 12 Attachment Tips
- Types of Attachments
- Senor Mounting

What is an attachment?

- A mechanism or device that is designed to assist in accomplishing a particular mission or missions.
 - Mechanical attachments physically interact with something to accomplish the particular mission programmed.
 - Sensors are devices and considered attachments. Their purpose is to provide input to the program to accomplish the particular mission programmed. For sensors to work properly, they must be mounted correctly.

12 Attachment Tips

Based on Dr. Ken Berry's Attachment Tips

Tip #1 Consistency

- Consistency, consistency, consistency, consistency, consistency, consistency,
- No, seriously, CONSISTENCY!!! It's important that your attachment behaves the same way every single time it use it. If it doesn't, then your attachment does not work.
- Robotics is not about luck, it's about consistency.

Tip #2 Respect your programmer

- The purpose of an attachment is to make the programmer's job easier. Try to make the attachment as compact as possible. (See next tip.)
- If touching the mat, reduce friction between the attachment and the mat as much as possible. Friction when moving greatly increases the programmer's job.
- Also, make sure the attachment helps your programmer guide your robot to the task and try to incorporate sensors (such as a touch sensor) into your attachment, it will help your robot know whether or no the task has been accomplished.

Tip #3 Leave room for error

- That one 2M axle on the attachment may be the perfect piece to accomplish the task at the other end of the mat when trying the attachment by hand, but it may not be the case for when it is used on the robot.
- Make sure that you can always hit the target no matter what. In order to do so you can make the attachment bigger to make sure that a little error will not affect the outcome.

Tip #4 Use the field pieces

- A lot of the field pieces are always there and don't move. Have your attachments take advantage of this. Running into your task, if done properly, can be very beneficial if you can make sure that your robot always ends up in the same position.
- If your robot is always in the same position after completing the task, it makes your programmer's job easier and it also opens up the opportunity to add more tasks in one run.

Tip #5 Merge

- Try to make as few attachments as possible.
- Merge attachments if possible.
- For example, if a task requires an attachment to be on the mat and another task to have an attachment way up high, you can merge those two attachments into one if doing so does not prevent the attachments to work properly.
- Merging attachments will reduce time in the base changing them out.

Tip #6 Life is too short

- Don't get hung-up on one mission.
- If you have absolutely no idea how to build an attachment for a task, don't try to build one. There are many other tasks can worked on.
- Building attachments is all about combining mechanisms. Maybe by working on an attachment for another task you'll find a way to accomplish the task you couldn't do earlier.

Tip #7 All for one and one for all

- Try to make all attachments so that they attach to the robot the same way.
- Spend time early to come up with an attachment mechanism that will be common to all your attachments. This will save a lot of time in the future.

Tip #8 You don't always need a motor

- You are permitted four motors only, use them wisely.
- Teams tend use a motor for everything even though there are ways to complete the task without one. If you really want to use a motor for more than one attachment, try to make sure the connection from the motor to your attachment is easy and doesn't require much fiddling with pieces.
- Motors should be used mostly for tasks that require precision and force at the same time or if you really need your attachment to spin.

Tip #9 Don't forget Galileo

- Gravity is free, use it. If you need something to fall, think gravity.
- There are many release mechanisms available to make things fall using gravity, use them, don't use a motor when gravity can do the same thing for free.

Tip #10 Rubber bands are your friends

- Rubber bands can, under certain circumstances, do the same job as a motor. At times, they can also do it far better and faster.
- Rubber bands are very useful for many things such as:
 - guiding your robot in position
 - compensating for gravity
 - releasing a lot of energy very fast
 - holding things in place
- Of course, rubber bands, especially the LEGO[®] ones, are fragile so use them wisely and have spares.

Tip #11 The need for speed

- One of the most important uses of axles is to mount attachments to the frame.
- Many teams use pegs, which can be hard to attach/detach cleanly during a robot game match.
- The use of axles, friction, and gravity for putting attachments on the robot minimizes time (and mistakes) in base.

Tip #12 K.I.S.S

- Keep It Simple Silly
- Less moving parts = less to go wrong or break
- Less moving parts are easier to maintain

Types of Attachments

Types of attachments

- The two main types of attachments are those that are programmed and those that are mechanical.
- Programmed attachments require command(s) from programming to perform its task. For example a moving arm.
- Mechanical attachments react mechanically to mechanical stimuli such as a door that closes itself after it is opened using a rubber band.
- Of course, there are attachments that are a combination.









Bulldozer

• Great for pushing objects around.





- Used like a forklift to pick items up.
- Can be fixed mounted or used with a motor.



Modified Rack

- A second support axle added
- Common mounting
- Three forks



Hook with motor

- Hook-types attachments can be useful in handle loops.
- Can be used to push or pull levers simply by repositioning the hook.

Trap box

- Trap type attachments are good at retrieving objects.
- Effective at retrieving balls and objects that roll.



Modified trap box

• Modified to reduce weight and use a drop-in mount.



Trap box - Type 2

- Axle gate to allow lighter objects to enter.
- Axles swing independently to permit lighter objects to enter.
- Uses common mount points.



Claw gripper

- Useful for grabbing items.
 - 4508600: Tool 4X12 Nr. 4 (2)
 - EV3 motor
 - Connector with Friction Cross axle (2)
 - Connector Peg with Friction (2)

LEGO® Digital Designer demonstration. http://ldd.lego.com/en-us/download/



SuGo styled plow

 SuGo styled plows are designed to push other robots out of a SuGo wrestling field.

http://www.sugobot.com/



Forklift

• Uses worm gears to lift and lower the forklift tines.



Caribiner

• The caribner demonstrates use of rubber bands for action.

