Robot Arm

SOSI 2012
Matt Chalker
chalker7@gmail.com
• Two pre-competition components
  – Robot Arm
  – Documentation
    • Three components
    • 10% off final score for incomplete documentation
    • 30% off for no documentation
    • Expected 1 week in advance, electronically

• Competition
  – Move Items from playing field to ½ gallon milk jugs
Construction Rules

- 30 x 30 x ∞ cm
- 14.4 V
- Remote control (wired, IR, R/C, pneumatic, etc.)
- Unlimited joints
- Number of motors is the first tiebreaker (fewer is better)
Documentation

• Engineering drawings (such as 3-views) showing:
  – All motors/actuators
  – All energy sources
  – All end effectors
  – Controls
List of components

• Includes every individual component except fasteners
  – Name of component
  – Location/vendor from where the component was purchased
  – 2 or more key properties (weight, dimensions, voltage rating, etc)
  – Energy source (n/a is acceptable)
Operating description

• Device reaction to every input
• Tentative/proposed plan of movement (strategy if there is a specific one)
Competition

• Event supervisor selects 4 components from their technical documentation
  – Students point them out on the device
  – -1 point for every component missed
• 5 minutes prep time next
• 3 minute competition time
Competition

- Playing field is 70 x 70 cm
- Robot arm sits in one corner
- Milk jugs around edge
- Move items from the playing field into milk jugs
  - PVC pipes, Nails, Unsharpened pencils, batteries
  - Various points for putting different
Competition Area

- West Goal: 70 cm
- North Zone
- North Goal
- Possible Bonus Jug Locations
- Robot Square
- South Zone
- East Goal
- 30 cm
- 70 cm
Construction notes

• Different types of robot arms
• Based on degrees of freedom (rotation points)
• Two major types useful for SO
  – Fully articulated, hemispherical
  – SCARA (crane type)
Hemispherical/Articulated
SCARA/Crane

• http://en.wikipedia.org/wiki/SCARA
General Tip

• Read the rules
• KISS
• Do not over/design engineer
General Tips

• SCARA is probably best
  – Faster
  – Simpler
  – More accurate
  – Can score all points

• Articulated is probably more fun for students
  – Can be used for other purposes
General tips

- Central joint is CRITICAL
- Weight at end of arm also important
- Stiffness everywhere
- Servos are better than motors
  - More expensive
  - Stronger
  - More precise
- DPDT switches can reverse DC motors
End Affectors

- Electromagnets
  - Easy
  - Cheap
  - Light
  - Cannot lift PVC, possibly pencils
- Hands/grippers
  - Complicated
  - Slipping
  - Adds another motor
  - Heavy
- Simple stick/rake
  - Lifts PVC only
Materials

• Motors/servos
  – Online, hobby shops, radio shack, etc.

• Switches/wire/etc
  – Online, radio shack, fry’s, grainger, surplus, etc.

• Building material
  – Balsa - hobby shops
  – Carbon fiber – hobby shops, arrows
Partial walkthrough
Joints (only a start, this is insufficient)
Links


• Basis for my sample: [http://luckylarry.co.uk/arduino-projects/arduino-robot-arm-larryarm-v0-1/](http://luckylarry.co.uk/arduino-projects/arduino-robot-arm-larryarm-v0-1/)