Robotic Arm System

* Summary:
  + Light robotic system built into Tango Lab to move, replace, and or remove individual experiments
  + Hybrid Cartesian-coordinate/arm system
  + Will increase autonomy and decrease dependency on human maintenance and operation.
* Functionalities/Capabilities:
  + Remove and place circuit boards with individual units attached
  + Move hand of arm to action position for specified unit
  + Screw/unscrew specified unit
  + Insert or remove specified unit
  + Pivot in at base and move to stow position
  + Pivot out to grab new experiments for insertion
* External dependencies:
  + Arduino or Raspberry Pi
  + Power Supply Unit
* Potential methods of control:
  + Human controller could control each moveable component individually (this option could also be available as a manual override provided with the following options). Using a controller or keyboard may prove difficult due to the lag from sending the user’s commands from Earth to space. This method could be compared to the “Claw Game” at arcades.
  + Human could specify coordinates that the linear actuators should move the base of the arm to then the arm’s individual components could be controlled like mentioned above.
  + Functions can be created in the code that the user can call with commands to move the “hand” of the arm to a position to act upon a specific unit (ex: “move hand to 2nd row, 1st column”) then other functions that can be called to act upon the individual experiment (ex: “unscrew @ current position”, “screw @ current position”, “pull unit out @ current position”, “insert unit @ current position”). The functions will make the robotic system using predetermined signals to manipulate it much like muscle memory in humans.
* Possible Limitations:
  + May require reduced max capacity of individual experiments if entire system cannot be produced in compact enough form.
  + Inadequate power could result in a malfunction or draw too much from Arduinos monitoring and regulating the experiments causing them to fail. Because of this, it is recommend that the robotic system uses an independent power supply unit.
  + Code for movement of components needs to be heavily tested for every possible scenario of component positions to make sure checking and repositioning at the beginning of every movement function is safe to prevent parts moving where they shouldn’t or cant and thus breaking themselves or other equipment within the experiment vessel (Tango Lab).