## Robotics Outreach Project

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### Goal
- To design, fabricate, and assemble an economical, multi-purpose kit for middle schoolers—specifically historically, underrepresented students in STEM.
- To provide an introductory, evidence-based curriculum that both instructor and students can learn and sagely assemble with assistance.
- To research materials and service methods to minimize cost without compromising the safety of potential users, and maximize production.

### Background
- 1 in 3 U.S. adults would like to see a greater emphasis on K-12 STEM education (Pew Research Center).
- The education system neglect students’ needs due to poor administration of resources (Darling-Hammond, L.).
- Current educational coding and robotics kits range from: $150-$600+.
- Research shows that students develop stereotype threat as early as the 2nd grade, which creates under-performance in certain contexts, and grows into adolescence.

### Design Requirements
- **Design Requirements:**
  - The top chassis should be able to withstand the weight of the arm structure, claw, and tennis ball.
  - The robot should be completely controlled by a human operator via Bluetooth.
  - The robot end-effector should operate in two modes: claw mode or image stitching mode.
  - The motors should have enough torque to hold the load of the arm and claw structure, and to lift a 60 gram tennis ball.
  - Train the computer to identify and differentiate a square and a triangle within 10 seconds.
  - Images taken through robot’s camera should be stitched by visual cues received by the laptop.
  - The robot will use infrared sensors to identify objects.

### System Details/Purpose
- The articulated arm is designed to be versatile and allow for the camera mounts on the end effector have been completed.
- The parallel claw gripper is designed to pick up tennis balls and other similar-sized objects of varying geometry.
- **PCB, Code, Image Stitching**
  - PCB designed in EAGLE that connects raspberry pi to camera mounts on the end effector.
  - MATLAB code in order to create a panorama utilizing large amounts of images captured on a single camera.

### PCB Schematic
- **PCB designed in EAGLE that connects raspberry pi to camera mounts on the end effector.**
- **MATLAB Simulations**
  - Example of the image stitching feature utilizing Matlab that will be used on the robot for the camera attachment.

### References
- National Research Council - How People Learn II
- Teaching and Learning STEM
- Pew Research Center

### Cost Analysis
- Does not include shipping, taxes, production costs, or PCB assembly Items are from screws, wires, washers, etc.
- Current PCB prototype is $25.00.

### Current Status & Next Steps
- Fabrication of the prototype has been completed.
- The anthropomorphic arm design with swappable claw and camera mounts on the end effector has been completed.
- Current robot controls are fully determined by the user.

### Next Steps:
- Test and iterate the arm, camera mount, and claw designs.
- Modify the controls to be partially or fully autonomous; ie: the robot will use infrared sensors to identify objects.
- Finalize the image stitching and recognition code.

### Team Structure
- **Project Lead:**          **Faculty Advisor:**
  - Edgar De Jesus Ramos Munoz  - Dr. Faryar Jabbari
  - Jesus Ramos Munoz, teachings of Dr. Natascha Buswell. P.I.,
  - This work was made possible under the guidance of Edgar De Jesus Ramos Munoz, teachings of Dr. Natascha Buswell. P.I.,

### Future Works
- Contact outreach programs to test learning strategies and kit redesign.

### Website Link
- www.posterpresees.com