BEEC Share and Learn Report: November 2023

Presenters: Naji Husseini, UNC and NC State University; LeAnn Dourte, University of Pennsylvania; May Mansy, University of Florida

Topic: ASEE Education Showcase Deep Dive: Hands On Activity

Resources:

Slides for Naji Husseini's Talk: https://docs.google.com/presentation/d/1wRGPeX0OA-6G2lMILHBIBK4aOqMfqabH/edit?usp=sharing&ouid=106458361084770552965&rtpof=true&sd=true

Presentations Overview:

- Naji Husseini: DIY Motion Capture
  - Tools Needed: Finger lights ~$30, rubber bands, tape, velcro
  - Programming Language: MatLab
  - Coding Topics: Color thresholding, segmentation, centroid location, find velocities of joints
  - Connects to their life, hobbies, and something creative
- Leann Duorte: Physical Biomechanical Model (using Wood)
  - 2nd Year Biomechanics (Statics and strength of materials)
  - Topics: Newton's 3rd Law: every action there is an equal and opposite reaction, supports provide translational and/or rotational support
  - Pre activity discussion – force and moments in equilibrium ($\sum F = 0, \sum M = 0$), Free body diagrams, normal forces (i.e. reactions)
  - Does NOT mention supports, new topic/concept being added
  - Tools Needed: Screw driver, screws, piece of wood with holes in it
  - Task: given steps to create a joint: elbow (hinge) joint), skull (fixed support), shoulder (ball and socket), then ask to pull apart in X,Y,Z and rotation to see where "support forces" would be, then translate these resistances of motions onto a FBD
- May Mansy: TENS Unit in BioSignals and Systems
  - Junior level Biomedical Signals and Systems Class
  - Link mathematical models to BME applications is the challenge, as students don't know what the number truly means such as signal properties (e.g. amplitude, signal power, frequency of signal)
  - Tools Needed: TENS 7000 dual channel stimulator (~$20)
  - Task: assignment on safety and warnings (e.g. pacemakers, DON'T USE), learn principles of TENS unit, quiz on consent that they read assignment and are opting in or out of assignment
  - Learning Activity: Try 4 electrode positions to see threshold of perception (talk about in lecture as well), vary amplitude, width and rate, and sense threshold of comfort
  - Body parts: finger flexion, wrist flexion, do in teams as unit is dual stimulator so can have 2 students do activity at same time
  - Reflection Activity: device design (ease of use/comfort/can use for patient vs. therapist?), personal experience (inter subject variability), relevance to other courses (stimulate nerve vs. muscle)
  - Limitations: good in smaller < 60 class size, needs 2-3 learning assistants to help, students need buy in (want to use it), and student obedience (follow rules)