

PROJECT-BASED LEARNING LESSON PLAN

Project: Barnabas Hologram

Required Materials: Flying Lead 130 size DC motor, Micro-breadboard, Large Popsicle Stick (tongue depressor size), Sticky foam, AA Battery, AA Battery Holder with Female Leads, 4-Pin Push Button, Arduino Wires (Male to Male), 3" x 4" Piece of Thick Cardboard ($\frac{1}{8}$ " - $\frac{3}{16}$ " in thickness), Chopstick with hole (approx. 2" long), Masking Tape, miscellaneous crafts

Outline/Steps/Activity:

- 1) Insert AA battery into AA battery holder
- 2) Attach arduino wires to battery holder leads
- 3) Adhere battery holder to bottom of one side of the popsicle using sticky foam
 - a) Add additional support for the holder on the popsicle stick by wrapping a piece of masking tape around the holder and stick
- 4) Hold the micro-breadboard vertically (like a hotdog) and place the button onto the micro-breadboard
 - a) Best practice: bottom, right-hand corner
- 5) Adhere micro-breadboard to popsicle stick on the same side, but just above the battery holder, (approximately the middle of the popsicle stick) using sticky foam
 - a) Place the sticky foam on the long side of the breadboard opposite the button
 - b) Placement of the breadboard should be so that the button (on the breadboard) is closest to the battery holder
- 6) Adhere the DC motor onto the other side and near the top of the popsicle stick using sticky foam
 - a) Placement of the sticky foam should be on the base of the motor; the base of the motor is the flat side without the wires attached to it
 - b) Make sure that the motor shaft is clear of the popsicle stick and is able to spin freely
- 7) Insert the black (-) battery holder wire onto the breadboard on the same row as B2 of the button
 - a) Important: to ensure that placement of wires are correct, position breadboard horizontally (like a hamburger); button should now be in the bottom left corner
- 8) Also, insert one of the motor wires onto the breadboard in the same row as B2 of the button
- 9) Insert the red (+) battery holder wire onto row A2 of the button
- 10) Insert the remaining motor wire also onto A2 of the button
- 11) Create the 3D hologram module
- 12) Drill hole in chopstick
- 13) Stick the chopstick into the bottom of the cardboard hologram
 - a) The end of the chopstick with the hole in it should be facing out
- 14) Stick the chopstick (with the hologram attached) on to the motor shaft
- 15) Use button to turn Barnabas Hologram on and off

Additional Notes:

- Using double-sided sticky foam may be challenging for some students
- Drilled hole in chopstick may be done ahead of time
- Drilled hole in chopstick should be done by an adult