Circuit Design (2/6/2020)

Objective: Read input from IR sensor and move servo. Servo is powered by external 9V source.

Materials:

- Multimeter
- Breadboard
- Potentiometer
- Arduino uno and nano
- Op Amp (LM 386)
- 1K resistor, 820 resistor
- 9V battery and terminal connectors
- IR Sensor (what type)

Schematic:

1) Voltage divider with equation + voltage follower
2) Overall schematic with potentiometer, IR sensor, and servo

Code Design:

Incremental procedure/improvements/observations/difficulties:

- note about how nano didnt work properly with servo, but uno works.
- Adjusting Vout of voltage source with voltage divider to best work with servo
- Prevent voltage lag

- Trying to incorporate all the Arduino elements (potentiometer, servo, external power supply, IR sensor)
    - With NanoArduino:
        - Tried servo + IR: the IR detects the object's presence, and print out what's inside the if statement. But the servo didn't spin.
        - Tried servo + IR + external power supply
        - Tried potentiometer + servo + Arduino power supply: didn't work (at this point, it's probably the NanoArduino that's problematic)
        - Tried JUST potentiometer (still with Arduino power supply) and print its value: didn't work either (potentiometer value always start at 92 and always drops to 50)
    - With Arduino UNO
        - Potentiometer + servo with Arduino power supply works

- Potentiometer + servo + external power supply (9V battery, without the voltage divider): the motor doesn't run smoothly. Hypothesis: the servo did not get the correct value of voltage so it doesn't work
- Potentiometer + servo + external power supply + voltage divider (to ensure that the servo got the intended voltage): apparently, in this case the potentiometer was using the power from external power supply so the reading of the potentiometer fluctuates, but still detectable if we go up or down the scale)
- Same setup as above, connecting potentiometer power supply directly to 5V of Arduino: potentiometer reading stabilizes, motor still doesn't work

February 18th?

Fixing servo not moving issue:

820 R1 and 1K R2 switched to 820 R1 and 1.8K R2

After getting code to work, but servo would not move, checked voltage across battery. Voltage was 8.6 V. Voltage across voltage divider was 5.6. Voltage across Voltage follower (op amp vout) was 4.6V.

Decided to increase voltage output of voltage follower by increasing vout of voltage divider (decrease R1).

New resistor values:
- R1 680 ohms, R2 1.8K
    - Result: 4.85V
- R1 560 R2: R2 1.8K
    - Result 4.99V

Tested motor and sensor with new resistor values: success!

LOOK INTO RECHARGEABLE 9V BATTERY

IMPORTANT NOTE/UPDATE:
20200305 WC
- Replaced small servo with 20kg servo, ended up just clicking and not spinning
- Methods of debugging:
    - Voltage check
    - Current check
- Tried to replace voltage divider resistors with resistors 1/10 of the value
    - Got really hot, still didnt move servo (click)

- Did research into potential problems with powering servo with 9V battery
    - https://electronics.stackexchange.com/questions/437032/powering-a-servo-with-9v-battery-and-other-questions
    - 9v battery problems
        - Low charge capacity
        - Low current output
        - Too high of voltage -> lose power/charge to voltage divider
    - Better to have 4 AA batteries provide 6V power, with a regulator or switch or transistor to prevent idle current draw
        - Removes need for op amp (voltage follower) and voltage divider
- Rework circuit design to incorporate 4 AA batteries

20200312 SN

- 4 aa batteries give 5.43 V when connected with 20kg servo
- Ammeter reads 0.02 uA
- Code works and should activate servo, servo doesn't seem completely dead, but doesn't work
- Smaller servo also reads 5.42 V but also doesn't move
- Attempted to clean up pin labels with variable definitions, no luck

20200518

- TIP120 NPN darlington transistor datasheet:
    - https://components101.com/sites/default/files/component_datasheet/TIP120_datasheet.pdf
- Resource to determine base resistor value (150ohms)
    - https://teachmetomake.wordpress.com/how-to-use-a-transistor-as-a-switch/

Results and Integration to Overall device:

Notes:

https://hackaday.io/project/66149-cat-sprayer/details

CAD

20200227 SN

Clamp case

- Printed a few iterations with slide pillars in horizontal stacks
    - Broke easily
- Tried printing pillars horizontally (printing along axis of pillar)
    - More sturdy
- Springs aren't short enough to go on the inside hooks, but the outside hooks work okay
- Need to extend grooved length, and try integrating the 3 slides
- For the top clamp, try having it slant down overall to hook underneath

20200302 SN

- Spring case design:
    - Connect neck and crown clamps with string for easy flexibility (maybe auto-coiling string like Simon's key chain)
    - For neck, put spring and poles on trigger side so bottle is easier to pick up
- Could have counterweight on bottom (with leaden bottle sleeve)

20200303

- Trigger sock holder.
    - Printed first version
    - Found fishing line (rated for 30lbs)
    - Seems to fit well over trigger, a little loose
    - Difficult to pull string to actuate trigger

20200304 JH

- Hinge-based nozzle case design:
- Printed to scale
- Widened space for nozzle
- Adjusted pieces to be mirror images

20200227 JH

- Hinge-based nozzle case design:
- Implemented new hinge design
- Implemented fully enclosed design

20200220 JH

- Hinge-based nozzle case design
- First iteration

- Casing for nozzle/head of spray bottle to act as containment/easy removal of auto sterilizer parts
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20200305 TO-DO:

- Remove front part
- Slit for battery; on the top-back of the case
- More room for motor on the bottom-back side of the case
- Room for potentiometer?
- Make the part in front of the trigger smaller
- Both sides of battery case need to be opened
- Make hinge bigger

Arduino Code

Updates:

- Potentiometer fixes
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Perforated Board and PCB Design

Objective: Remove bulky, messy wiring and breadboard bulk/weight. Design a perf board to create a more compact, slim circuit design; decrease weight, increase organization. Use as stepping stone to designing a printed circuit board which will be even more compact, and permanent.

Materials:

PERF BOARD DESIGN

- Perforated boards
- Dip socket
- Resistors
- Solder
- Wire
- Op amp
- Arduino

PCB DESIGN

- Surface mount devices
    - Op amp
    - Resistor (0805)
    - Atmega

Perf board approach:

- FIGURE OUT ATMEGA
- Sketch a perf board layout to incorporate all components without too much extraneous wiring
- Tape components into place on perf board
- Draw lines with sharpie, solder components onto board, connect solder points
- Check for continuity and no unwanted short circuits.

PCB schematic and design approach:

- Look into surface mount devices, especially the atmega
    - Any additional devices, encoding software, extra steps needed?
- How to mount, which sizes
- Choose which devices we want for the project (consider device size, power rating, voltage limits, etc)
- create schematic in eagle. Include specific devices to be used in schematic
- Design the actual board layout, consider layers and ask about suggestions

Procedure/Log

20200305 Perf board - WC

- Perf board design.
    - Draw a sketch of circuit schematic
    - Translate into perfboard layout sketch
    - Double check
- Collect components and fix to board.

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One Way Valve and Nozzle Design (2/6/2020)

CAD design process, iterations

- From predesigned pins to insert pin

Why this scale?