TBot 2000 Proposal

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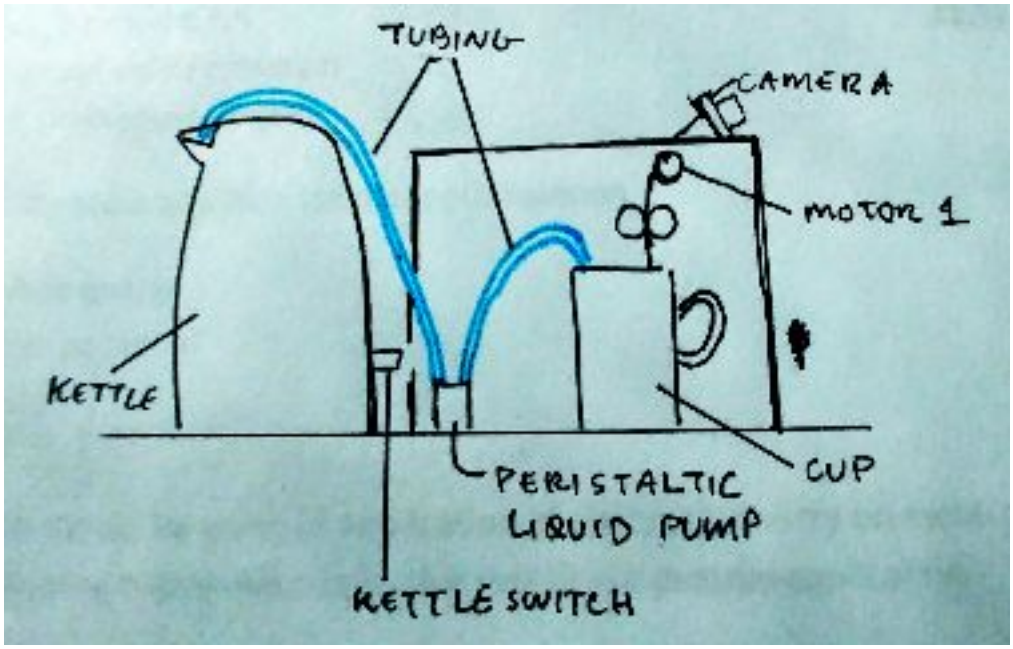
Function of TBot 2000

The TBot 2000 handles the pouring and steeping steps of the tea-making process.

1. Turn the TBot 2000 on
2. When the TBot 2000 detects a face, it will prompt the user to fill the electric kettle with water, attach a tea bag to Motor 1, and specify the steeping time
3. The electric kettle will automatically shut off when the water has boiled
    a. In doing so, its switch will revert back to the “off” position
4. The TBot 2000 will detect when the switch has returned back to the “off” position and initiate the pouring process
    a. The the liquid pump will turn on and fill the cup with hot water
    b. The pumping is halted when the the water is determined to have reached the water line
5. The TBot 2000 sets a timer for the steeping process and turns Motor 1 to lower the tea bag into the cup
    a. When the timer has ended, Motor 1 will turn to lift up the tea bag
        i. In the process, the tea bag will be passed through rollers in order to squeeze out liquid
6. The TBot 2000 will alert the user through audio-visual signalling (an alarming sound and flashing lights)
    a. When a face is detected in front of the box, the door will open to welcome the retrieval of the cup of tea

Diagram



Materials

- 2 NXT motors
- 2 H-bridges
- 2 NXT cable breakout boards
- 2 9V batteries
- 2 microcontrollers
- Peristaltic Liquid Pump with Silicone Tubing (www.adafruit.com/product/1150)
- Cordless Electric Kettle
- 1 Stepper motor
- 2 solid cylinders on axles (for the rollers)
- 1 LCD Display

Idea: make a cup of tea

- User fills kettle with a certain amount of water, probably 0.75L
    - We should buy the cheapest automatic shutoff kettle we can find (about $15) something like
    - https://www.amazon.ca/Salton-JK1641B-Cordless-Kettle-Black/dp/B01MRRI6IA/ref=sr_1_14?ie=UTF8&qid=1526647441&sr=8-14&keywords=cordless+electric+kettle
- User starts the kettle manually
- While the kettle is boiling, the user can set the steep time for the tea and attaches the teabag
- We can set up an electronic switch on the kettle's switch so that when it closes (indicating the water is done boiling) we can detect it
- Arduino lowers the teabag into the mug
- Arduino tilts the kettle to pour the water into the mug
    - We need to rig the world's biggest funnel for this part
    - Alternatively, we could buy a pump like https://www.adafruit.com/product/1150, but that costs $35 and also we would need to get food-safe tubing
    - Even if one NXT motor isn't strong enough for this, we can hook up two (or three) in parallel through a differential (thank you, VB). It's actually really easy with LEGO, there's a brick designed for it.
- Arduino lets the tea steep, then removes the teabag
- Optional extra features
    - Run the teabag through rollers as we lift it to squeeze it so it drips less (definitely doable)
    - Put the teabag in the trash (definitely doable)
    - Use a motor to start the kettle
    - Slide the mug out from the steeping area when steeping is done

List of components:

- 2 or more NXT motors (as many as needed to tilt the kettle)

- 1 H-bridge per NXT motor (using ICs would be nice, but if not we can build them by hand, it isn't hard)
- Optional: 1 NXT cable breakout board per motor (I can cut and strip more cables if needed, but I would rather not mutilate more of my cables and I don't trust the solder job on the one I did very much)
- 1 9V battery per NXT motor
- 1 microcontroller per NXT motor
- 1 stepper to raise and lower teabag
- Optional: 1 servo to swing teabag if we're putting it in the trash
- 1 central microcontroller
- Pot as time selector (or +/- time buttons, but a pot seems swankier and requires fewer IO pins)
- 7-segment display to show steep time/time remaining, depending one where in the boil/steep cycle we are
- BCD-7 segment decoder
- 1 very large funnel-type thing catch the water from the kettle

Control of peristaltic pump:
http://www.instructables.com/id/Control-peristaltic-pump-with-TA7291P-and-an-Ardui/

Facial detection with Raspberry Pi and OpenCV:
- Getting frames from the Pi Camera module to OpenCV: https://www.pyimagesearch.com/2015/03/30/accessing-the-raspberry-pi-camera-with-opencv-and-python/
- Face detection: https://docs.opencv.org/master/d7/d8b/tutorial_py_face_detection.html

Datasheets
- TIP31: http://www.onsemi.com/pub/Collateral/TIP31A-D.PDF
- Stepper: https://www.sparkfun.com/datasheets/Robotics/SM-42BYG011-25.pdf

TODO
- 5 turns to raise/lower bag
- 4:45 to transport water

Program structure
- While kettle switch closed, adjust steep time
- When kettle switch open, turn on boil LED
- Wait for kettle switch closed
- Turn on steep LED
- Transport water (4:45)
- Lower teabag (5 turns)
- Wait steep time
- Raise teabag (5 turns)

- Turn on ready LED