Milkshake Machine

ESDM Project

Figure 1: MilkShake Machine

General description

1. Create and test Simulink model containing a state machine implementing the control logic of a milkshake machine.

2. Write a report on the project, containing:

    a. An overall description of the design (how it works, states, transitions etc,).

    b. Some tests of the functionality (2-3 tests, depending on complexity, covering normal usage and some error scenario)

    For each test, indicate:

    - The test scenario: what are the inputs, what are the desired outputs
    - The test results: include screenshots from the tests, to prove the tests work

Requirements

1. The milkshake machine can produce 3 beverages:

   - cold milkshake
   - warm milkshake
   - hot milkshake

2. The Simulink model has the following inputs and outputs:

   Inputs:

   - ColdMilkshake button (boolean)
   - WarmMilkshake button (boolean)
   - HotMilkshake button (boolean)
   - Cancel button
   - Milk level sensor (number, 0 to 1000 ml)
   - Milk temperature sensor (number, 0 to 100 degrees Celsius)
   - Motor speed sensor (number, 0 to 100 rpm)

   Outputs:

   - Activate Motor (boolean)
   - Activate Milk Heater (boolean)
   - Activate Milk Pouring (boolean)
   - Machine Status (integer):
     - 0 = IDLE
     - 1 = WORKING
     - 2 = NO_MILK
     - 4 = HEATER_FAULT
     - 5 = MOTOR_FAULT
     - 6 = POURING_FAULT

3. The beverages have the following recipes:

   - Cold Milkshake:
     - Activate shaker motor for 2 minutes
     - No heating
     - Afterwards, start pouring the milk
     - Pour until milk level drops by 200 ml
   - Warm Milkshake:
     - Activate shaker motor for 2 minutes
     - Then heat the milk until temperature reaches 60 degrees
     - Start pouring the milk
     - Pour until milk level drops by 200 ml

- Hot Milkshake:
  - Activate shaker motor for 4 minutes
  - Then heat the milk until temperature reaches 90 degrees
  - Start pouring the milk
  - Pour until milk level drops by 200 ml

4. The cancel button stops every ongoing operation of the machine

5. The cancel input button shall be debounced both ways, with a time duration of 0.25 seconds.

6. Fault control:

   - Before making anything, check if you have enough milk (check the milk level sensor input). If available milk is not enough for the beverage, signal via Status output (NO_MILK)

   - If the motor is activated but the speed drops below 10 rpm at any moment, the motor is broken. Signal this error via Status output.

     This does not apply for the first 2 seconds after activation (during the first 2 seconds the motor speed is allowed to be smaller than 10 rpm).

   - If pouring is activated but the milk level does not drop 200 ml in less than 5 seconds, the pouring is blocked. Signal this error via Status output

   - An error status remains set until the cancel button is pressed. Until then, no other operation is permitted.

7. Use parameters from Matlab for all values you consider necessary (e.g. duration of times etc.). Our customer may want to adjust the parameters at any time.

8. Test your state machine (use one/multiple separate test models if necessary)