Milk heating - new feature analysis

1. Purpose

This analysis refers to the request to add functionality to heat up the milk using the Cup-O-Joy 7.0.

2. Request analysis

In the new feature specification and description it is stated that the warm milk should be deposited to the coffee receptacle via a nozzle. It is also stated that triggering of depositing the warm milk should be done by pressing the 'Action' button.

The above implies that the same system built in elements for water pumping, heating and tubes for transferring water from the water container to the heating element, and from the heating element through the coffee container and on through the deposit exit nozzle should be used for milk heating and pumping as well.

3. Solution proposal – additional elements

Analyzing acceptance criteria from the given document the following proposal is concluded.

For the new functionality we should have two additional elements for the Cup-O-Joy 7.0 that would be used just for the purpose:

- Milk container – which will be used similarly as the water container and instead of it
- Milk filter – which will be used similarly as coffee container and instead of it

4. Technical specification of the additional elements

Milk container

The amount of milk in milk container for normal operation is between 10ml (minimum) and 200ml (maximum). There are two lines on the wall of milk container to indicate minimum and maximum amount.

Milk filter

Milk filter has the same outside shape and size as the coffee container. The difference is that milk filter cannot store any substance inside.

Setting the milk filter into the coffee container slot will indicate to the system that the milk will be heated in the next cycle. Automatically, it will set the brew temperature to 60°C.

The technical team should add system functionality as described below:

- Setting the milk filter in the coffee container slot should trigger setting the brew temperature to 60°C. The slot should recognize the difference between milk filter and coffee container and based on this, trigger setting the brew temperature for milk heating.

5. Solution proposal process overview

Precondition for the process of heating the milk is that the HE is empty.

Milk is stored in the milk container and from there transferred through the heating unit by the water compressor.

By pressing the 'Action' button to turn on the system, the water pump will pump milk into the HE. The water pump will pump the whole amount of milk stored in the milk container (10ml – 200ml). The water pump will maintain the whole amount of milk in the HE before the HE reaches the set temperature, 60°C. Once the milk is heated to the set temperature, the heated milk is transferred through the milk filter. The milk does not stop at the milk filter unit and passes on through the deposit exit nozzle into the receptacle below.

There is no information on the display to show the status of the milk.

Pressing the 'Action' button once will trigger the processes of pumping milk in the HE, heating the milk and right after that passes it on, through the milk filter and deposit exit nozzle into the receptacle below.

6. Potential risks which may arise from the introduction of the new functionality

Precondition for the process of heating the milk is that the HE is empty. That implies that water container have to be empty after the last cycle of coffee preparation, before the milk heating.

There are security issues regarding these circumstances. They are described in Cup-O-Joe 7.0 documentation_01.02, points:

- 4.2.4.1 Water level below the minimum required mark

If the water level in the WC is below the minimum required mark, indicated by a line on the WC, the infeed pump responsible for pumping the water to the HE may pull air into the tubes which would cause malfunctions of the HE and disruptions of pumping the heated water to the CC.

- 4.3.2.6 No water

In case the water level in the WC is below the minimum amount, the pump will not stop working. The pump will pull air into the HE.

! Pumping air to the HE may cause the HE to malfunction and deteriorate at a much faster rate.
HE with air in it could cause excessive heating of the surrounding components and their malfunction.
Excessive heating of the surrounding components may cause structural deterioration.
Excessive heating of the surrounding components may cause injuries to the end user.

In addition to the above, it is important to note that the new feature uses elements that are primarily intended for water pumping, heating, and transferring from one element to another.

There should be technical examination to confirm that the built in elements could be used for milk as well as they are used for water. Those elements are:

- Heating element
- Water pump
- Water filter
- Tubes

7. Impact on basic functionality and product

Cup-O-Joy 7.0 basic functionality is making coffee. New feature, milk heating implies storage and passage of milk through elements that are not available to the end user for cleaning.

Therefore, drops of milk will certainly remain inside the heating element, water filter and tubes.

It means that after the milk heating cycle, the next cup of coffee will definitely contain a smaller amount of milk or traces of it.

8. Impact to test plan and testing process

New tests for new elements, milk container and milk filter should be added.

In test plan there should be addition and specific milk heating option to points:

- 2.1.1 Outer body, brand, components overview – add two new elements
- 2.1.2 Processes to be tested – add the process of milk heating as well as the process of creating the preconditions for milk heating
- 2.1.2 Features and processes not to be tested, conditions for stopping the testing process, exceptions – this part of plan predicts that the processes that may create a security issue will not be tested. The new feature implies that those processes have to be done.
- 3.1 Processes to be carried out by end users – add the milk heating process
- 3.2 Test scenarios – add scenarios to test the new feature in all stages of the process
- 4.2 Test cycles – add new cycle for testing the new functionality
- 7.1 Testing project tasks and time estimation – add 4 days for testing new feature