

Smart Multi-Herbs Distiller Robot

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1 Presentation of the Problem

Tunisia is a country well-known by distillation of aromatic plants like Citrus, Thyme, Rosa Canina, Wild Rose,... to obtain aromatic waters or/and essential oils used in food, medicine, aesthetic preparation needs. Until now, distillation process is a manual hard work, requiring time, accuracy, continuous supervision, mechanical and electrical energies...

2 Suggested Solution

To solve these painful problems, an intelligent system is proposed to put work self-acting, to improve precision and product quality, and to reduce distinctly energies consumption.

The novel distiller is an intelligent robot that has the capability to treat all types of herbs. It is composed of three principle parts :

- The first part is an intelligent closed-loop for an electrical heater to reach desired value of temperature for the water boiling in a special conic flask placed above the heater. The conic flask is divided into two floors, the bottom floor is reserved to water, and the top one is occupied by one kind of aromatic herbs.
- The second part is an other intelligent closed-loop applied to a condensing unit to cool the water vapour and to prevent temperature increasing in the output tube.



Figure 1: Primitive Distiller in 2017.

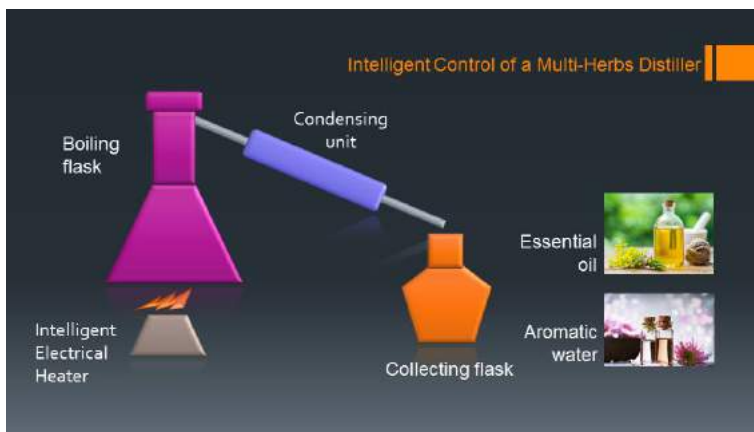


Figure 2: Intelligent Distiller.

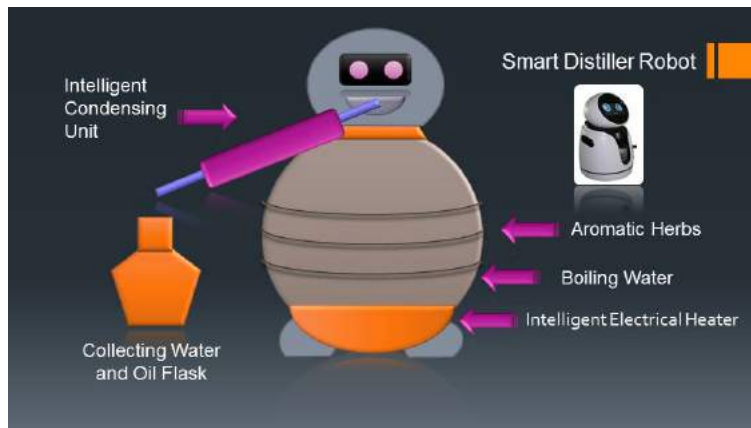


Figure 3: Smart Distiller Robot.

- The third part is the collecting flask where aromatic water stayed down and essential oil remains at the top, a nanoseparation is introduced in this flask to separate properly the oil to water.

We notice that the solution is based on artificial intelligence known as "Fuzzy Logic Theory" that allows control acting as a result of logical human reasoning of errors correction and this method do not require system parameters and models but needs human expertise with the operation of the distiller system. The novel distiller is a smart robot with articulated parts in one mechanism that can generates exact signals to each part with rapidity and accuracy. Electrical energy, also, can be replaced by photovoltaic source. A micro-controller is installed in the brain of the robot where a control algorithm is implemented and managed the different components of the distiller robot. The distiller can have the form of humanoid robot.

3 Description of the Design

The first step of this idea is to calculate a dynamic model of the different operating steps of the distiller and generate a numeric simulation of inputs and outputs signals variations in order to understand internal phenomena. The second step is to develop an entire command system based on "Mamdani" and "Sugeno" fuzzy logic sets using an adequate expertise of the manual



Figure 4: Components of the distiller robot.

distiller mechanism.

The control process is, thereafter, implemented on a microprocessor card generating the necessary command signals to the system actuators. Temperature, humidity and level sensors are introduced to communicate informations to the control process.

The mechanical design is chosen as a funny humanoid robot with a cylindrical body with two feet and spherical head. An electrical resistance is putted in the bottom part of the body, connected to a power supply on the one hand, and the control unit on the other hand. A thermometer can transfer the water temperature for regulation to maintain the required value.

The part just above is a water balloon with the necessary amount mentioned by a level sensor. If the quantity of water decreases outstandingly, an automatic order triggers a new pouring to the desired level.

The third part in the body is reserved to plants and herbs. Between body and head, a vertical pipe permits the boiling water drops to flow towards the condensing unit through the mouth.

The process unit where installed the intelligent control system is mounted in a box placed on the back of the robot.