# “Dinner for One”

# Automatic Waffle Machine


**The Project Team:**

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**Initial position:**
Our team consists out of four students of the Technical School of Automation Engineering in Mainz and we are in our last year. For being graduated we have to work out a final project. In this project we want to develop a special waffle machine. When learning about the Xplore competition we thought of taking part with our idea to show that simple things like baking waffles can be automated.
From a school partner we got a retired robot of the company Fanuc Robotics with a RJ 2 control for training in school. We think of integrating this robot into our waffle machine.

**The idea:**
The customer will be registered over a sensor and welcomed by the robot. Afterwards the customer has to enter his wish. With the help of an operating panel he can choose what kind of waffle he would like. Then the procedure will start and the customer sees how his delicious waffle is going to be baked freshly in front of his eyes.
Over supply pipes the ingredients should be added to a container where they will be stirred with an electric mixer machine. After the pastry has been mixed sufficiently, it should be led to the waffle iron and thereby the baking process will be started. If the process is finished, the robot is to put the baked waffle on a plate. A conveyor belt should transport the waffle to the next station, where end refinement will be made. Here the waffle is to be covered with chocolate syrup, cinnamon or icing sugar, depending on order and pre-selection.

During the process of baking the robot works as a butler and sets the table for the customer with knife, fork and napkin. "Table, set yourself!" Possibly another beverage (i.e. a drink) is served. Then the robot takes the plate with the freshly made waffle from the conveyor and serves it to the guest. Enjoy your meal!

**The conversion:**
- With a sensor/push button the plant is to be taken into operation.
- With an operating desk (touch panel) the customer can decide on the topping of the waffle mentioned above.
- After receiving the signal the six ingredients are to be added. They are fastened in individual containers on the frame construction. The supply to the stirring bowl will be installed with a time or quantity controller. In the bowl the pastry will be stirred/mixed with the help of a pneumatically driven stirring system for a given time.
- After completion of the time-steered mixing process the baking mixture is to be led over a hose system directly into the waffle iron.
- An additional supply pipe is to be installed to secure that the waffle iron is greased a bit with oil before it will be filled with the baking mixture again. Aim is to prevent the pastry from burning on the iron.
- The baking procedure begins and takes three to four minutes.
- After completion of the baking procedure the handling robot is to open the waffle iron and place the freshly baked waffle on the available plate.
- The plate is to be transported on a conveyor belt to the next station where the end-refinement is going to be executed according to the customer's entered selection.
- As soon as the correct topping is on the fresh waffle the robot should serve the plate on the set table for the customer.

**Ingredients and toppings needed for baking:**
For preparing a delicious waffle butter, sugar, eggs, flour, baking powder and milk are needed for the baking process. To fulfil the personal wish of the customer cinnamon sugar, icing sugar or chocolate syrup should be offered on the touch panel. Also other toppings are possible.

**The decorated table:**
We take a plate, a napkin, a knife and a fork to create special atmosphere at the table.

**Equipment:**
First of all we need a waffle iron, which is suitable for automation engineering. For serving the waffle we will use a handling robot with a gripper.(handling tool). The available robot from Fanuc Robotics with RJ-2 control has already a gripper installed. Further constructions are needed, e.g. a table, a shelf with fastened containers for the ingredients and a shelf for the table decoration. Moreover a tilting stirring bowl is needed, as the pastry must be poured into the waffle iron.

**Basic data of the plant:**
A pneumatic and an electrical driven stirring system are responsible for mixing the ingredients. Safety devices in the form of light barriers and signalling equipment in the form of signal lights are used for process control and for the person's protection. Several containers with time-controlled inlet pipe for the ingredients mentioned above will be mounted to the conveyor belt and fill the stirring bowl.
An assembly line is to be built, on which the plates with the baked waffle are transported to the station where the toppings are added.

**Required hard & software:**
For the connection of the personal computer with the programmable logic controller (PLC) automation software named PC Worx is used. A bus system (Interbus) of Phoenix Contact guarantees the information flow. For the movement of some objects a handling robot with grip arm of the company Fanuc Robotics is used. The whole system is visualized with the visualization software (PROVISIT).

**General safety installations:**
To ensure security for all persons light barriers and\or light curtains will be installed as well as sensors on personal dangerous places of the plant (see attached sketch).

**Possible special effects:**
With the help of especially made moulds for the waffle iron logos could be baked into the waffles, e.g. the logo of our school - BBS 1 Mainz or the logo of a company like Phoenix Contact or anything else, for advertising purposes on fairs or special events.

**Vision:**
We expect after the presentation of the waffle machine a good prototype, for plants baking waffles designed as an automat which could serve in places like a shopping centres, companies or in schools a delicious product to sweeten everyday life spontaneously.