

## USE CASE

# How to Develop an Automatic Coffee Machine Using the CELUS Design Platform

### INDUSTRY

Consumer electronics

### PRODUCT

Automatic coffee machine

### COMPLEXITY

Medium

### NUMBER OF PARTS

Around 103

### NUMBER OF CONNECTIONS

Around 982

## Automated Design Processes Strip Cost and Waste Out of Mainstream Product Development

The demand for modern consumer products is growing. Thanks to low-cost sensors, electronics engineers can add new functionality to basic goods. For example, the lowly coffee machine now has sensors that enable it to prewarm carafes, start and stop automatic brewing, and temporarily pause drip operations when a user removes the carafe. All these features – and others – help automatic coffee machines deliver a better user experience.

Although automatic coffee machines are found in almost every home, they're still moderately challenging to design. Electronic engineers like you need to research and source components, conduct a feasibility analysis, and design printed circuit board (PCB) floorplans and prototypes. It also would be beneficial for engineers to create reference designs for reuse and developing related products, such as a next-gen coffee machine.

This use case provides a simple guide that walks you through the process of creating an automatic coffee machine. Our goal is to demonstrate how easy it is to use the CELUS Design Platform to optimize your design processes and help you work more efficiently. While we selected an automatic coffee machine for review, you could use the steps outlined here to create any electronic or smart product of your choice.

»Engineers that use the CELUS Design Platform can reduce development times by up to 90 percent.«<sup>1</sup>

### Optimizing the Design of Mainstream Products

If you're designing a mainstream product like an automatic coffee machine, you likely want to:

- Source components more easily and make sure they're available
- Work more efficiently, managing larger product portfolios
- Speed up design processes to accelerate time to market
- Move intellectual property from Excel spreadsheets to a secure database
- Optimize designs to reduce costs or achieve other goals
- Create new product variations to grow sales and market share

<sup>1</sup> CELUS estimate, based on client experience.

## A Step-by-Step Guide to Designing an Automatic Coffee Machine

The artificial intelligence (AI)-powered CELUS Design Platform gathers technical requirements and generates schematics, and Bills of Materials (BOMs) that are compatible with leading industry electronic design automation (EDA) tools. And it does all of this at the touch of a button. As a result, it's easier than ever to turn great ideas into innovative electronic designs. Let's begin work.

### 1. Gather technical requirements:

To build a coffee machine, you will need to determine all functionality including push buttons, temperature and other controls, and an on/off switch.

### 2. Capture functionalities:

After logging into CELUS, you can start capturing functionalities for your new project. For an automatic coffee machine, they might look something like this:

## Coffee Machine Architecture

### WATER LEVEL DISPLAY

Six LEDs to display water level at different twenty-percent increments.

### PUSH BUTTONS TO ENABLE USER INTERACTION

Six buttons for a settings menu; up/down navigation through menu; and shortcuts to brew a small, medium, and large coffee.

### WATER TEMPERATURE CONTROL FOR DIFFERENT COFFEE TYPES

One temperature sensor connected to the brewing system, which must be capable of measuring temperatures up to 95°C.

### MAIN ON/OFF FUNCTION

One electromechanical switch for the mainboard.

### MACHINE STATUS MEASUREMENTS

To detect process success or failure and user actions. They include a/an:

- Current position sensor pressing motor on brewing unit (magnetic sensor)
- Initial position sensor of pressing motor on brewing unit (magnetic sensor)
- Status sensor of pressing motor on brewing unit (magnetic sensor)
- Water pump status (magnetic sensor)
- Sensor to measure water level (magnetic sensor)
- Sensor to measure the level of the beans (infrared sensor)
- Sensor to measure the level of the disposal container (infrared sensor)

### A COFFEE POWDER PRESS

One bidirectional motor control unit for the DC motor that activates during the brewing process.

### CONTROLS FOR

A grinding motor for the coffee beans, water heating element, water pump, and dispenser. These controls include four on/off single direction controls for the motor, a 230V AC rectified load switch, and an optocouplers driver to separate the mainboard supply from the AC mains supply.

### AN LCD DISPLAY

A 16x2 LCD display that provides information and warnings on machine status and coffee selection.

### MACHINE AND ELECTROMECHANICAL SYSTEM CONTROL

A programmable microcontroller that enables different coffee programs and controls electromechanical systems.



## Add More Value to Your Design Work

With smart algorithms, it's easy to create effective designs with less work. But you can also use the CELUS Design Platform to add more value to additional tasks as they may occur in your day-to-day business. Here's how:

- **Conduct feasibility studies:** You can use CELUS to analyze different component options to optimize designs for specific variables, such as cost. As a result, you understand the best options before you proceed with the PCB floorplan.
- **Share designs internally:** With digital workflow, you can seek input from other team members, approvers, or purchasing. As a result, you know that designs will be approved by all key parties, speeding the time to manufacturing.
- **Create design variations:** Want to develop similar products, such as upmarket or down-market goods based on your original design? Using your reference design, you can create alternative designs in minutes, optimizing them for new requirements.

## Get Started With CELUS Today

The CELUS Design Platform automates manual and time-consuming processes, so that you can focus on creating the best designs.

### Work more efficiently



[Learn more](#)

### CELUS GmbH

Ridlerstraße 57, 80339 München  
+49 (0)89 2555 2424 · [info@celus.io](mailto:info@celus.io)

[celus.io](https://celus.io)

© 2023, CELUS GmbH. All rights reserved.

Information described herein is furnished for informational use only, is subject to change without notice, and should not be taken as a guarantee, commitment, condition or offer by CELUS. CELUS, the CELUS logo, and all other CELUS product names and logos including the name Cubo are trademarks or registered trademarks of CELUS and/or its subsidiaries in Germany and other countries. All other product or company names are property of their respective owners.