

## Project Initiation Document: Latte Art

Leah Brown, Luke Swetonic, Jacqueline Bendziewicz, Mariah Tam, Elise Ferkler, Derrick Joyce  
Instructor(s): Dr. Hassan Raza  
Intelligent System Design II  
Electrical and Computer Engineering  
Clemson University

Project Charter: one line (Scope, Time, Cost) WHAT?

Build a Latte Art Machine by April 17, 2023 for \$450

Objectives: what are the deliverables? (approximately 3 lines) WHAT?

- Build a machine that creates latte art
- Integrate motors actuators with a Raspberry Pi
- Use python to control motors and create a usable GUI

Background: along with the associated state of the art with References (3 lines) WHY?

A robotic latte art machine has not been done before in the visible history of Clemson senior design projects. Online, there is a latte art project that has been completed by a group of students at another university, however the execution of the latte art designs is entirely different from how we are approaching the task. We aim to make the latte art using a spout and pouring in specific motions to create designs similar to a barista, rather than using a pen to draw designs or use stencils.

Approach: outline the method being used (approximately 3 lines) HOW?

Espresso will be brewed using a separate coffee maker and poured into a cup which is placed in the cup holder. Milk will be frothed separately and placed in the milk holder. The coffee cup will be on a platform that will tilt. The milk cup will tilt, as well as move horizontally and vertically to pour milk into the cup in a design such as a tulip.

Organization: project organizational structure, e.g. specific role of various team members. WHO?

- Programmers: Derrick, Luke, Mariah
- Builders: Leah, Jackie, Elise
- Integrator: Elise, Luke
- Manager: Jackie, Leah

Resources Management: What resources are required in milestone 1, 2? (Approximately 3 lines for each milestone and the final demo – write them down separately for each milestone and the final demo)

- Milestone 1 - We will make the physical components of the assembly by 3D printing parts and using parts in the lab. We will also determine all the hardware required, including stepper motors and actuators. We will assemble everything on a base and wire the electrical components to the Raspberry Pi. We will also decide which programming language to use.
- Milestone 2 - We will create a base code to control all the motors simultaneously. In the current design, there will be 1 axis of movement for the coffee cup and 3 axes for the milk cup. We will refine the integrated movement of both components and test with just water to begin with.

- Final Demo - We will continue to refine the movement of all the motors and begin to test with coffee. We will also develop a simple GUI to start the process. This will require paper cups, coffee pods, and milk.

Risk Management: Constraints and Assumptions (approximately 3 lines)

We may be limited in cost because our design might require linear actuators. Linear actuators that can handle heavier loads are expensive. We need to ensure the platform is light enough to be moved up and down. We are assuming that the device will only produce one design and additional designs if time permits. We are also assuming that the motors available in the lab have precise enough control to create the designs.

Change Control: Outline how changes (if any) would be implemented? (approximately 3 lines)

- Changes will be implemented with the component working separately first
- Changes will be tested with water prior to using the mil
- All changes will be consulted with the whole team before any changes are made

COVID-specific planning of how to include online and/or overseas students if applicable: (3 lines of how group is going to carrying out the tasks with COVID-restrictions?)

The only COVID restriction that needs to be taken into consideration is lead times. If we decide that we need to order specific parts, we need to order them promptly to account for any delays.

Acceptance: <u>Leah Brown</u>	<u>Jackie Bendziewicz</u>	<u>Elise Ferkler</u>	<u>Derrick Joyce</u>	<u>Luke Swetoinc</u>
Student 1	Student 2	Student 3	Student 4	Student 5

References:

[1] <https://pic-microcontroller.com/ece-4760-latte-art-machine/amp/>

[2]

[3]

[4]

[5]

Add more if applicable.