Automated Cookie Making Machine

ME 4930 – Senior Design Project | Members: Calvin Brice, Andrew Grumbles, Austin Owens, Jared Weberpal

Sponsors

University of Wisconsin-Platteville College of Engineering, Mathematics, and Science Student Success Program, Dr. Jessica P.M. Fick, Dr. Anne-Marie Lerner, Tammy Salmon-Stephens

Background

The University of Wisconsin-Platteville's College of Engineering, Mathematics, and Science's Student Success Program wanted an outreach tool to illustrate concepts of Science, Technology, Engineering, and Math (STEM) for students of all education levels. This will be accomplished by developing an industrial manufacturing based automated cookie making machine. This interdisciplinary machine, when finished, will be able to dispense ingredients, mix, form, and bake a cookie to user specifications.

Previous design teams have developed the ingredient dispensing elements of the machine and concurrent design of a transportation mechanism by a separate senior design team is being developed alongside this design team's efforts to create the mixing and forming mechanisms.

Future teams will focus on refining the integration between all final elements of the automated cookie making machine. This will cover the user interface, power supply, and baking process.

Objective

The design team was tasked with creating the mixing and forming mechanisms of the project. The following characteristics are included in the design

- Engages students from kindergarten through college
- Demonstrates STEM concepts
- Easy to assemble and disassemble
- Easy to clean

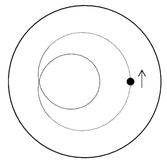
Challenges

Food Allergies

Cleaning all surfaces of the machine in contact with possible allergens requires significant care, more than standard cleaning after use. To eliminate contamination, toppings that are common allergens will not be used. Contamination from the main ingredients found in cookies is unavoidable due to limitations in cleaning; consumption of cookies should be avoided for those with allergies to these ingredients.

Mixing Dough

Normally, dough is prepared in a batch for multiple cookies. The small amount of dough required for an individual cookie makes mixing all the ingredients properly very difficult. This further complicated the design of the mixer. An epicyclical mixing design was utilized to accomplish uniform consistency.

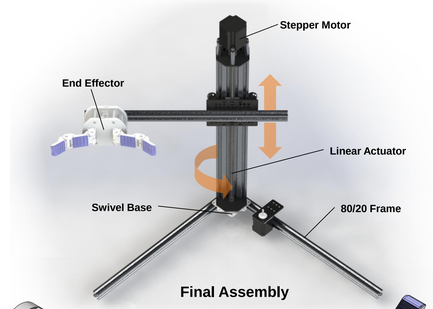


Designs

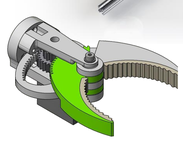
Gripper

Info
The "Gripper" picks up the container of ingredients and moves it to the "Mixer" and then the "Former"

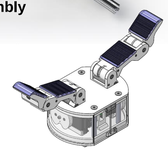
Functions
- Grasp
- Rotate
- Raise/lower



Final Assembly



End Effector Design 1

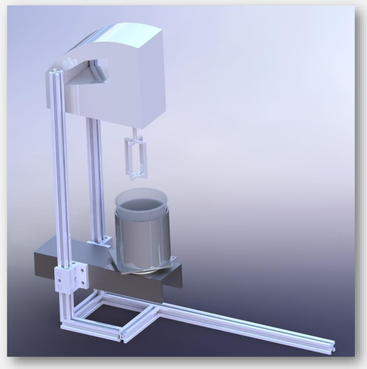


End Effector Design 2

Mixer

Info
The "Mixer" receives the container of ingredients and lifts it to the "Mixer" for mixing

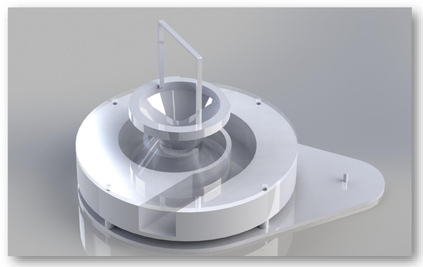
Functions
- Hold container
- Lift container
- Mix
- Lower container



Shaper

Info
The "Shaper" removes the dough from the mixing cup and spins it into a finished ball ready for baking.

Functions
- Scrapes mixing cup clean
- Spins dough into ball
- Self-lubricating

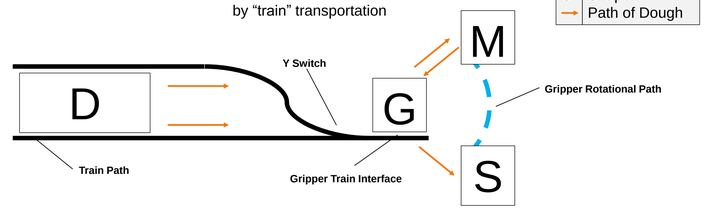


Final Design

Top View Layout

Info
Ingredients will be moved from dispenser to different elements of the mechanism by "train" transportation

D	Dispenser
G	Gripper
M	Mixer
S	Shaper
→	Path of Dough



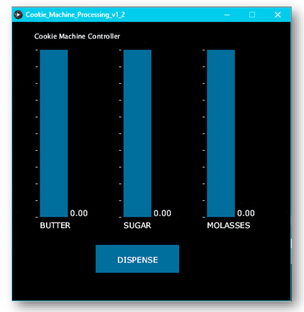
Arduino Uno Board

- Arduino Uno microcontroller selected for controls due to ease of use and open source documentation
- Arduino Shields used for attaching multiple stepper motors to microcontroller
- I^2C communication protocol used for connecting multiple Arduinos together

Arduino Uno R3

User Interface

- Processing IDE (Arduino IDE was built on the Processing IDE so it is directly compatible)
- Sliders and buttons
- Allows for selection of ingredients
- Optimized for simplicity



Prototype User Interface

Future Revisions/Iterations

- Power supplies consolidated
- Component refinement
- User interface update
- Automate butter dispenser
- Create Educational Documentation
- Improve visualization of product flow
- Ensure food safety

Acknowledgements

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