Team Flour Power: Dispense-O-Matic

Objective

Need for Product:
Problem: Baking/cooking preparation
- Repetitive
- Time consuming
- Inaccurate
- Spatially inefficient

Market Size*:
Households: 2,122,498
Businesses: 12,379

*In the Baltimore-Washington Area

Customer Requirements:
- Dishwasher safe
- Mobile
- Dependable
- Intuitive to use

Engineering Characteristics:
- Low coefficient of friction
- Strength of materials
- Power required
- Stability
- Counter Space
- Storage Volume
- Weight

Constraints:
- <18" inches height
- <24" inches in depth
- FDA approved materials
- Incremental movement

Customer Survey Results

Design

Operation:
Goods stored in top unit [1] fall into sifter mechanism [3-4] which breaks up clumps and facilitates movement of goods into barrel-auger mechanism [7-8] where is dispensed into the bowl [2]. Amount is determined through feedback from the weight sensor located in the base of the support structure [9].

Requirement Satisfaction:
- Removable sifter, storage unit and auger barrel for dishwasher safety.
- Simple to disassemble for mobility
- Durable materials
- Intuitive touch-screen for selecting amounts and units

Trade-offs:
- Speed for precision
- Mobility for storage capacity

Prototype and Testing

Speed Test:
Compared the average time needed to dispense a cup of flour manually and automatically.

Accuracy Test:
Compared the average accuracy of measuring a cup of flour.

Manual Dispensation:
- Average Time = 16.18 seconds
- Standard Deviation = 3.387 seconds

Automatic Dispensation:
- Average Time = 62.8 seconds
- Standard Deviation = 12.56 seconds

Concept Generation

Concept 1:
Advantages:
- Controlled dispensation
- Stable
- Conserves vertical space

Disadvantages:
- Many moving parts
- Counter space requirement
- Low storage capacity

Concept 2:
Advantages:
- High storage capacity
- Fewer moving parts
- Low energy requirements

Disadvantages:
- Potential jamming
- Heavy
- Potentially unstable

Concept 3:
Advantages:
- Controlled dispensation
- Can be measured by weight

Disadvantages:
- Susceptible to clumping

Concept 4:
Advantages:
- High storage capacity
- Fewer moving parts
- Low energy requirements

Disadvantages:
- Potential jamming
- Heavy
- Potentially unstable

Final Concept:
- Vertically oriented container has high storage capacity
- Heavy base structure keeps system stable
- Sifter/auger dispenser system breaks up clumps in material and controls rate of dispensation.
- Weight sensors for measurement

Test Results and Future Work

Summary of Results:
- The manual method is statistically quicker than the automatic (the p-value is 1.11*10^-5).
- The automatic method is statistically more accurate than the manual method (the p-value is 0.0432).
- Rate of dispensation of auger does not match that of the sifter.
- Weight sensor needs to be recalibrated

Future Recommendations:
- Improve control system by having better communication between the motors running the sifter and auger.
- Improve measuring system
- Larger pitch in the auger for faster dispensation
- Auger motor with larger step size and more torque

Customer Survey Results

- Counter Space
- Storage volume
- Weight
- Durable
- Storage
- Intuitive to use

Advantages:
- Controlled dispensation
- Can be measured by weight

Disadvantages:
- Susceptible to clumping

Related Patents:
1) Elevated ingredient dispenser
2) Valve assembly for dispensing condiments
3) Precision measurement dispenser

ENME472 - Integrated Product and Process Design and Development
Team Members: Joshua Barrett, Eric Borrero, Matt Cox, Jillian Ferrick, Sean Hays, Laura Stayman