Objective

Around 72% of people flip meat on the grill more than is necessary when cooking food, and 38% regularly deal with undercooked and overcooked meats. This product aims to properly cook food for consumption with ease.

Baltimore/DC Area Market Size: 217,000 households

Concept Generation

AHP Weighted Characteristics
- Grate Depth 9.44%
- Grate Length 6.52%
- Temperature Reading 28.08%
- Timing to Cook 32.66%
- Grate Range of Motion 9.36%
- Power Source 13.94%

From the AHP, it was evident that concept 2 was the best selection. This was then the concept used for testing and prototyping.

Final Weighted Concept Scores
- Concept #1 0.3449
- Concept #2 0.3734
- Concept #3 0.1355

Prototype and Testing

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Initial State</th>
<th>Rare</th>
<th>Medium Rare</th>
<th>Medium</th>
<th>Medium Well</th>
<th>Well Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thawed</td>
<td>12.19</td>
<td>12.39</td>
<td>12.63</td>
<td>12.87</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

Testing:
- (done without rotating grate)
- Average temperature taken inside grill
- Timing to manually cook meat compared to calculated times from code.
- Flipped food once at half of total time

Results:
- Timing too long, need to assume greater temperature under flame
- Needed one extra flip to cook more evenly
- Lean meat performs better because no flare ups
- Temperature stable
- Placement on grill important

Design

Operation
- Input Cooking Preference → Output Timing to Cook
- Output Time to Turn Motor → Input Timing in Motor Code

Grate Installed in Grill

Key Functionalities:
- Cooks food properly
- Handles multiple types of food
- Grate opens easily
- Food secured when in rotation
- Cooking times calculated
- Optimal latch strength
- Indicates when cooking complete

Tradeoffs:
- Since grill used is not very large, had to sacrifice amount of food cooked at one time.
- Temperature difficult to regulate consistently so assumed constant ambient temperature.

Prototype and Testing

Test Results and Future Work

Design Process Summary:
- Determined market and customer need for easier and safer grilling
- Created timing code for cooking based on heat transfer concepts
- Tested cooking times to manual grilling
- Applied timing to motor code which would turn food hands-free
- Designed prototype to test timing and motor codes

Future Work:
- Integration of timing code with motor code.
- Expansion of grill size
- Addition of second grate

Reflection:
- Testing helped to improve validity of timing code
- Weight characteristics helped define scope of project

ENME472 - Integrated Product and Process Design and Development