The Illuminators: Bright Idea

Objective

General need for the product
-Convenience, speed, and safety of changing a light bulb

Description and estimation of market size
-Handicapped people, the elderly, and families
-1 million people in the Baltimore-Washington Metropolitan Area

Customer requirements
-Easy to use
-Install and remove light bulbs
-Reliable
-Will not break light bulb
-Reach ceiling
-Works quickly and efficiently
-Work on different type and size light bulbs

Engineering characteristics
-Maneuverable
-Head with directional rotation
-Proper grip strength
-Specific rotational speed so grip is not lost
-Adjustable gripper, for different size light bulbs
-Simple controls
-Stable when at maximum length

Constraints
-Cordless device (battery powered)

Concept Generation

Concept 1
-Pro: Spring-loaded grippers
-Pro: Extendable arm
-Con: No angled attack

Concept 2
-Pro: Unique gripper head
-Pro: Varying angles and heights
-Con: Lose stickiness over time
-Con: Drop bulb with large angle

Concept 3
-Pro: Gyro will avoid tangling
-Pro: Bike brake system to grip
-Con: Not extendable

Prototype and Testing

-Process selected for the fingertips has a higher melting point than the maximum temperatures of the light bulbs (40, 60 and 100W)
-All bulbs tested can withstand greater than 13lbs of force, which is greater than the springs exert.
-By knowing the maximum temperature and stress of a light bulb, cheaper materials can be used in manufacturing

Test Results and Future Work

Summary/PDP Reflection
-Designed a motorized light bulb removal/installation device.
-Device was designed to handle a variety of different bulbs.
-Setting design parameters and weighting/selecting design elements was an important step
-Concept generation process allowed for careful creation and selection of prototype design
-Modeling and simulation processes allowed for the testing and subsequent selection of materials and product dimensions

Future Recommendations
-Add an extendable body for greater versatility
-Include an elbow-jointed head unit for access to angled lights
-Add a torque limiter to unit’s motor for improved safety

Alternative Devices
-Other alternative light changing devices exist in the market but none are motorized.
-Examples of competing companies are: Bayco and Ettore

<table>
<thead>
<tr>
<th>Yield Strength (lbs)</th>
<th>Bulb Type</th>
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<tbody>
<tr>
<td>18 lbs</td>
<td>40W In</td>
</tr>
<tr>
<td>16 lbs</td>
<td>60W In</td>
</tr>
<tr>
<td>16 lbs</td>
<td>100W In</td>
</tr>
<tr>
<td>20 lbs</td>
<td>CFL</td>
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DEPARTMENT OF MECHANICAL ENGINEERING

Date: 05/03/11

ENME472 - Integrated Product and Process Design and Development
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