Background

- Tend to overdose and leftover
- Assist the physically challenged
- Current Available Dispensers
  - Mostly Mechanical
  - Electric ones lack adjustability
Project Objective

- Precise control of the amount dispensed
- User interface to adjust toothpaste amount
- Easy to assemble and clean
Final Design
Circuit Design
Modules

- I/O Peripherals
- Control and Software
- Power Supply
- Mechanical
Control and Software
- CPU
Control and Software

- Software

- Battery is turned on
  - True
    - Sensor voltage > thread sensor voltage
      - True
        - Drive motor for seconds of preset toothpaste value
      - False
        - Output 0V voltage to motor
    - False
      - Output 0V voltage to motor

- Calculate and write current battery level to LCD

- + button is pushed and toothpaste value < 9
  - True
    - Toothpaste value ++
  - False
    - - button is pushed and toothpaste value > 1
      - True
        - Toothpaste value --
      - False
        - Write current toothpaste value to LCD screen
I/O Module
- LCD screen
I/O Module

- Pushbutton, IR sensor, Battery monitor

3s LiPo
9~12.6V

100kΩ

47kΩ

2.88~4.02V

Processor:

+5V

10kΩ
Power Module
- Buck converter

3s battery

12VDC

Buck converter

5VDC

Motor

Processor
Power Module - Motor and drive

Control signal from the processor

Control signal from the processor

"Continuous Dispense" button

+12V

10kΩ

2N4401 4.7kΩ

S9012

2N4921

4.7kΩ

4.7kΩ
Mechanical Module
- Peristaltic pump
Mechanical Module

- The shell
## Verification

<table>
<thead>
<tr>
<th>Item</th>
<th>Verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell-dimension</td>
<td>214<em>80</em>50mm</td>
</tr>
<tr>
<td>Pump-precision</td>
<td>±0.04g</td>
</tr>
<tr>
<td>Power-voltage precision</td>
<td>±0.01V @ SS</td>
</tr>
<tr>
<td>Sensor - detection</td>
<td>Active high</td>
</tr>
<tr>
<td>Power-motor drive</td>
<td>Able to be controlled by 5V</td>
</tr>
<tr>
<td>Processor-motor control</td>
<td>Digital High/Low</td>
</tr>
<tr>
<td>LCD screen-display</td>
<td>Settings &amp; Battery</td>
</tr>
</tbody>
</table>
# Performance

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>9~13 VDC (3S Li-Po)</td>
</tr>
<tr>
<td>Idling Power</td>
<td>0.42 W</td>
</tr>
<tr>
<td>Pumping Power</td>
<td>3.2 W</td>
</tr>
<tr>
<td>User definition range</td>
<td>0.1~0.9 g</td>
</tr>
<tr>
<td>Pumping Precision</td>
<td>±0.04 g</td>
</tr>
</tbody>
</table>
Conclusion & future works

- We realized our design!
- More compact packages
- Less power consumption
Acknowledgement

Thank Cypress Semiconductor for sponsoring part of the project.

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Thank you!