Medication Reminder and Shampoo/Conditioner Audio Device
for a visually challenged and forgetful client.

A National Science Foundation Engineering Design Project

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Outline

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- External Casing
- Budget
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Medication Reminder

Introduction

Client Background

○ Name: Mrs. Smith
○ Age: 80
○ Difficulty: Frequent states of confusion
  - Forgetful of taking medication
  - Forgetful of remembering if medication was taken
Objectives

- Address 3 Problems:
  - Inability to independently remember to take medications
    - **Solution**: Medication Alarm System
  - Inability to recall which medications to take due to states of confusion
    - **Solution**: Clear Visual display/communication of which medications are to be taken
  - Inability to provide reliable answer to whether medications were or were not taken
    - **Solution**: Log taken of user/client interaction accessible by caretaker
Current Products Available

Automatic Monitored Pill Dispenser (MD2)
- Stores large quantities of medication
- Alerts caretakers if medication are not dispensed or if medication is running low
- 3 way reminder system: Voice, Text, Blinking Light
- Built in power backup
- Expensive ($750 + $30 monthly monitoring service fee)
- Large and non-portable
Current Products Available Cont.

- **PDA Medication Reminder programs**
  - New technology recently introduced and recommended as simple and effective way to help patients remember to take their medication correctly.
  - Current programs available are far too complex for users who are old.
  - Program is combined with daily tasks also which can get mixed up.
  - Level of detail in the programs available makes the font very small to read on a small display screen which is not suitable for our client needs.
  - Our program will track remaining amount of medicine left and an alert feature when medication is running low.
External Casing

- An external casing will be manufactured for the specific model PDA.
- To protect the PDA from impact and scratches to the display screen.
- Casing made from 2 materials
  - 6061 Aluminum
  - Clear Polycarbonate
Medication Reminder

# Budget

<table>
<thead>
<tr>
<th>Component</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDA</td>
<td>$99.00</td>
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<tr>
<td>External Casing (Aluminum sheet)</td>
<td>$62.61</td>
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<tr>
<td>External Casing (Polycarbonate sheet)</td>
<td>$9.68</td>
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<tr>
<td>Additional Accessories</td>
<td>$37.98</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$209.27</strong></td>
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</tbody>
</table>

Available Budget: $750

(Provided by National Science Foundation)
Subunits
Conclusion

- The device will...
  - Provide a reliable medication reminder for the client
  - Allow the client to regain independence in her daily routine
  - To create a program suited more for clients who are older in age unfamiliar with high tech devices.
Introduction

- Mrs. Smith
- Elderly woman suffering from poor memory and vision.
- Cannot effectively wear her glasses in the shower. She can see the shampoo/conditioner bottles themselves, but has trouble reading the bottle labels.
- Tends to forget size, shape, or color coding methods of identifying the shampoo/conditioner bottles in the shower.

Shampoo/Conditioner Voice Device
Objectives

○ To construct a device that will help Mrs. Smith distinguish the shampoo from the conditioner bottles in the shower.

○ This device should...
  ● be safe to use in the shower
  ● be simple to use
  ● be lightweight
  ● Emit an audible “Shampoo” or “Conditioner” when Mrs. Smith selects a bottle.
Current Products Available

- Toys for small children to remember the names of shapes and colors
- Shampoo/Conditioner Dispensers
- Sensory security systems that set off alarms that emit verbal warnings when a motion sensor is tripped
Internal Device Subunits

- Color Sensor
- Microcontroller
- Extended memory storage chip
- Digital to analog converter
- Signal conditioning circuit
- Speaker
- Potentiometer/On-off switch
Shampoo/Conditioner Voice Device

Color Sensor

- Sensor Detects a predetermined range of light wavelengths.
- Sensor communicates directly with microcontroller.
- One of two distinct signals are sent to the microcontroller depending on the wavelength of light detected.
Microcontroller

- Microcontroller takes the color sensor output and calls the appropriate audio file address from the memory chip.
- The audio files contain voice feedback data. There’s a file for an audible “Shampoo” or “Conditioner”.
- An additional audio file will be made in response to a low battery which will hold an audible “Please Replace Battery”.

![40 Pin PDIP Microcontroller](image-url)
Extended Memory Storage Chip

- EEPROM: Electronically Erasable Programmable Read-Only Memory.
- 1MB capacity.
- Data Retention of over 200 years!
- Withstands temperatures of up to 85 degrees Celsius.
D/A Converter

- Microcontroller takes voice feedback data and directs them to the Digital to Analog Converter.
- Gives a voltage output ranging from ground to the maximum supply voltage.
- Supplies the converted signal to the speaker amplifier.
Speaker

- Cone made of acrylic treated cloth for water resistance.
- Maximum power of 8 watts.
- 500-6.5kHz frequency range.
- Rated impedance of 20Ω.
- 2” Diameter, 1.2” depth.
Signal Conditioning Circuit

- Uses a fourth order low pass filter to eliminate potential quantization noise from the digital to analog converter.
- Low pass cutoff of roughly 12kHz.
- Amplifies the 0.6V\text{max} analog signal to a 16V\text{max} signal.
Filter Frequency Response
Potentiometer/ Switch

- The potentiometer used for volume control (Wilbrecht Electronics) will double function as an on/off switch.
  - Eliminates need to waterproof the on/off switch as a separate trans-casing element.
  - Makes device function easier for client.
- Will be waterproofed with a small washer sized gasket in conjunction with industrial strength glue.
Shampoo/Conditioner Voice Device

Convenient Features

- **Low Battery Warning**
  - Operation time will be measured with microcontroller’s timing circuit/crystal. After 20 minutes of no action, a program interrupt procedure will result in a low battery warning.

- **Volume control**
  - Client can set volume to whatever level she likes.

- **Overhang Hook**
  - To hang the device over the shower curtain rod or the shower-head pipe.
Device Casing

- Outer Casing made of expanded Rigid PVC (Polyvinylchloride).
- Sensor Window made of Clear Cast Acrylic.
- Access panel made from 3/16” layer of PVC. Lined with Gasket made of EPDM Rubber.
Outer Casing (PVC)

- Good chemical and corrosion resistance.
- High strength to weight ratio.
- Mildew Resistant.
- Easy to machine.
  - Most of casing will be etched out of a solid 2” sheet of PVC to minimize the amount of seams water can eventually leak through.
  - Rear panel will be cut from a 3/16” sheet of PVC.
Sensor Window (Coated Cast Acrylic)

- High optical clarity.
- Smooth surface.
- 45 times as abrasion resistant as uncoated acrylic.
- Flame retardant.
Battery Compartment

- The battery compartment is completely sealed off from the rest of the device interior.
  - Access to the batteries can be achieved through a small panel on the side of the device.
  - Battery access panel is sealed with rubber gasket, and screwed shut.
Gaskets (EPDM Rubber)

- Ethylene Propylene Diene Monomer
- To provide a reliable seal for removable parts.
- Flexible to form a tighter waterproof seal.
- Resists water, steam and detergents.
- Temperature range is -55° to +300°F.
- Withstands pressure of up to 180 psi.
- Used to seal all seams of device where water could otherwise seep through.
Gaskets (cont.)

- For sealing the rear panel.
- For sealing the Battery compartment.
- For sealing the speaker edge.
Maintenance and Accessibility

- Regular maintenance of this device is limited to:
  - Cleaning soap scum, residue and water residuals from the sensor window.
  - Replacing the batteries.
Waterproofing

- Panel seams and speaker edge are the only possible means of water entry.
- Once originally sealed, the rear panel will never need to be removed by the client.
  - Device interior remains an originally sealed capsule.
- Dessicants (Silica Gel)
  - To absorb any moisture that may find its way in over time.
### Shampoo/Conditioner Voice Device

#### Budget

<table>
<thead>
<tr>
<th>Key Components</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors</td>
<td>$5.70</td>
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<tr>
<td>Device Casing (In Total)</td>
<td>$53.52</td>
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<tr>
<td>Sensor Evaluation Board</td>
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<td>Microcontroller</td>
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<td>Circuit Board</td>
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<td>External Memory Chip</td>
<td>$3.82</td>
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<td>Speaker</td>
<td>$50.00</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>&lt;$392.51 (52% of available budget)</strong></td>
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</tbody>
</table>

**Available Budget:** $750  
(Provided by National Science Foundation)
Shampoo/Conditioner Voice Device

Conclusion

- The device will...
  - Distinguish between the shampoo/conditioner bottles while in the shower so that the client will not have to.
  - Be as easy to use & maintain as possible.
  - Be safe & waterproof for shower use.
  - Allow for greater customizability.
  - Actively conserve battery life.