Background

Physical objects that abound in our daily lives are often soft, curved, and organic. Information presentation methods using chemical reactions onto everyday objects have been proposed.

To create everyday display, low-cost computer controllable mechanism should be developed to activate chemical reaction.

Our Approach: Render ionic color patterns onto open wet objects using computer-controlled electrolysis.

Electrolysis Ion Display

Working Principle

Dot-matrix electrodes

- Electrodes (before wiring)
  - “A” in pink
  - “C” in pink
  - “C” in amber

Customized-shaped electrodes

- Personal fabrication of customized pattern electrode using gold leaf is possible

Actual color dots

Ionic equations

- Anode (oxidation reaction)
  - $\text{KI} \rightarrow \text{K}^+ + \text{I}^-$
  - $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$
  - $\text{I}_2 + \text{I}^- \rightarrow 2\text{I}^-$
- Cathode (reduction reaction)
  - $2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$

$\text{KI}$ reacts with the electrode and water to produce color dots.

Circuit

(a) Circuit diagram

(b) Electrode

- 35 pixel electrodes are connected to active matrix circuit
- With control from Arduino, each electrode is switched to three states (anode, cathode, and insulator)
- By reversing polarity of electrodes, existing dot fades and contrasting color dot emerges

Implementation

Implementation of Electrolysis Ion Display

- Paper soaked with solution containing color indicator
- Electrodes
- PCB
- Microcontroller

Possible Variations

- Stamp tool
  - Change pattern and color dynamically without moving parts or ink

- Augmented food
  - Bread in turmeric sauce
  - Berry panna cotta stamped with ACM logo

- Sand display
  - Smiling face pattern on the sand appear by sprinkling water