System Design

Basic Design

We propose to use the following methods for the Size and Summer images in the same location.

A single image rations below each label. Apples are colored blue by the consumer.

The image (string) can be modified or made easier to read immediately after taking the picture.

The image gets the color information from the user.

The user uses the same control bar on the rest of the photo taking.

Other Considerations

There are other issues that may be covered by other HP technologies.

The orientation of the apple must be controlled except when and. (from here type)

Precise vertical position of the apple is captured, as an additional camera is used to take a second picture.

The vision of the picker is captured and the image is stored in a separate database.

The link does not usually do this before reaching the start stage; an active display is added after the printout.

Ink on apples

Apple skin is in the outermost layer of the fruit and it is placed around the green skin color along the line of the fruit and also adding the diffusion of chemos from outside.

The cuticle layer of the apple skin is a composite of wax in a wax layer material that makes it strong and not easy to water. The body acts as an adhesive to the cuticle and the wax layer of the fruit.

Surface characterisation

Since apple skin is much more hydrophilic than paper, the normal substrate for HP’s water-based ink, HP needed to find a special ink for their proposed technology. The team collected information on the skin’s wettability, composition, and roughness and delivered the data to HP when they ink chemist made a preliminary ink selection.

Ink selection

The contact angle of the wax was measured to the ink selection. Also referred to as wettability, this is the test indicating the hydrophilicity of the surface.

The contact angle between the wax and the apple skin was measured for nine different waxes with various polarity. These measurements were then used to calculate the surface energy of each type of apple skin and create a waxing envelope indicating appropriate polar and dispersion components for an ink conducive to printing on apples.

System parameters

With the selected HP ink and an ink jet industrial imager, we began testing the interactions between the ink, the imager, and the apple to establish a preliminary set of recommendations.

Pen to media distance

Because the height of the apple sitting in the conveyer cup ranges significantly, an acceptable pan to media distance range had to be established. We determined that the imager will print to a visually acceptable test pattern (shown right) from at least 0.8 mm.

Curvature

Depending on the curvature type and its orientation, an apple surface has a curvature ranging from about 0.3° radius to about 7 mm. We assumed that these various curvatures affected the visual integrity of an image. For radii as small as 0.3° and proper pan to media alignment, we found that the imager can print acceptable images of 0.3° x 0.5° or smaller.

Print dry time

The time necessary for a print to dry was also measured, using passive drying, blow dry, and chill, and blow dry for each culture. Blow dry consistently resulted in the shortest dry time.

Business Case

About 50 Million boxes of apples require stickers currently, or between 4.3 to 5.5 billion apples. Depending on the type of sticker used in the calculation, which range in price between US $2.1 and US $3.2 per thousand, the number of stickers used in the US can be reduced between US $2 and US $3.2 per thousand.

Competing Technologies

For the past ten years, Simclon has dominated the sticker market based on the quality of their equipment and a few patents that lower their production costs. Simclon currently leases their labeling equipment at a small cost, but requires producers to purchase only Simclon’s stickers and sign a contract. They also offer maintenance for free and are recognized by the quality of their service.

The price of Simclon stickers varies depending on size, design, and features. The simplest sticker costs US $3.16 per thousand, but prices can be as high as US $3.5 per thousand. Last year, Simclon sold 50 billion stickers to producers.

Proposal for operations

We recommend that HP operate according to established industry standards in order to allow resistance to the implementation of this technology. This involves the following: outcome production of equipment, sign long agreements with packaging companies which include a minimum purchase of ink volumes, offer equipment free of charge and set up leases for installed equipment, sell through the network of current distributors and offer commissions on sale of ink to guarantee installation of equipment, maintenance, and service, maintain in-house procurement and distribution of ink through a dedicated website. The objective of this proposal is to leverage the resources of partners with investments in the industry and to reduce the need for HP to invest in a distribution network.

In order to assess this project, four scenarios were evaluated and our conclusion is that we believe that the opportunity to sell products with technology is a worthwhile investment for Hewlett-Packard.

Managing Risks

The main risks of this project are rejection of the technology by consumers, reaction of Simclon and other competitors, lower than expected adoption by packers, changes in regulations, delays for U.S. HP ink production, and introduction of new labeling technologies.

Acknowledgements

The Ono College HP SCOPE team sincerely extends our gratitude to Hewlett-Packard for providing us with such a meaningful learning opportunity. We would like to specifically thank Wayne Johnson and Dave Meeks from HP Anderson for initiating this project and helping us get started. Additionally, we are indebted to the HP Corra team (Jester Ortiz, Marvin Berlotti, Julio Castiglioni, Andrea Goosseau, Victor Gersheon, and Joel Genauer) for their invaluable hospitality and extremely valuable guidance and support.