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**GREEN LASER: AN APPLICATION TO ENCOURAGE “GREEN”
CONSUMER SPENDING**

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Green Laser

An Application to Encourage “Green” Consumer Spending

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Abstract—Green Laser is an iPhone application, currently pending approval in Apple’s AppStore. Our tool enables a consumer to quickly and efficiently scan a barcode and view ratings for a given product. We argue that providing a user with a listing of ratings, normalized on a 1-5 scale, is more worthwhile when making point-of-sale decisions in locations such as groceries and retail stores. We hope that by offering and encouraging the use of our dataset other applications can build from and contribute to it in hopes of furthering advocacy for green consumer habits.

I. INTRODUCTION

THE smartphone market has exploded in recent years—mainly due to Apple’s iPhone, which many hailed at the time as a “game changer.” The abundance of smartphones in our society today offers us the unique opportunity to monitor and track our activities in a variety of manners. For instance, Nike has produced a jogging application for the iPhone and Android operating systems which enables users to automatically send their information to social networks as well as Nike’s website—the goal of which is to help runners understand the distances, duration and rates at which they jog so that they can make improvements in their daily regimen. Other utilities exist to help smartphone users find the best prices on products, locate the nearest movie theater, or even play a full-length video game. Mobile computing has become ubiquitous in a variety of manners today, and we believe that this context could serve as a catalyst for producing social change.

Many scenarios exist for which a smartphone can be used to help make users aware of information that, previously, would have required lengthy, difficult and unreliable means of research to find out. Today, we see that this is no longer the case. We opt to introduce a mobile application, Green Laser, which allows users to identify and analyze their spending habits in real time.

Green Laser is a consumer tool built for Apple’s iPhone platform. A barcode scanner is used to scan a given product’s UPC label, decide what product it is and return ratings pertaining to the given product in order to help a consumer understand how “green” his or her purchasing habits are. Currently, our app is waiting for approval in Apple’s popular

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AppStore. Once approved we intend to gather metrics relating to how long consumers are using the app, what barcodes are being scanned that we cannot return ratings for, and what locales are the most popular for tools of this nature.

In order to decide on how to use a mobile-platform for our initial idea, we developed several iterations of this application before finalizing a method of displaying information and the user interface. This allowed us to test two main versions of our application which both displayed information about companies and products, but in vastly different ways. Our final implementation hinges around aggregating green data about products, companies, and brands from a variety of sources into an easy-to-parse format for an end-user.

To validate our approach, we compared our final product with that of a similar type of application, GoodGuide. GoodGuide’s methodology for creating green product information involves individually rating a company’s products and publishing that information via the web and mobile applications. We believe the findings of our user study help to validate that there is a valuable space for aggregating information from many sources into one format about a given product, company or brand as we describe in later sections.

Ultimately, we hope that Green Laser’s backend database serves as a springboard for organizations to utilize and contribute to in order to generate as many ratings for as many barcodes we can find. Though our aims might be a bit ambitious, we believe that Green Laser serves as a strong first step in this direction.

The remainder of this paper is divided among the following sections: Related Works, Implementation of Green Laser, User Study, Results, Conclusions, and Future Work.

II. RELATED WORK

A few conferences and journals have started to appear in recent years relating to mobile computing. Such conferences analyze various aspects in the mobile space addressing many current issues such as: security, battery-life preservation, creating ad-hoc networks for developing nations, and applications which range from mobile payment systems to micro-blogs. The International Conference on Mobile Systems, Applications and Services (MOBISYS) [1] is geared

towards many of these types of issues. Current research in the application domain for conferences such as MOBISYS regularly see submissions which make strong use of user studies and human-computer interaction factors as in [2], [3] and [4]. In [2] we see that a mobile payment application is evaluated by a user-study that asks participants if they prefer cash payment methods of their mobile payment solution, and also measure the time it takes to complete such tasks. CrowdSearch is presented in [3], which makes use of crowdsourcing methods via Amazon’s Mechanical Turk to decide if two pictures (taken from a mobile phone) are of the same object/building/person. In [4] we see an application, LiveMail, is tailored towards creating personal avatars for mobile phones, which animate based on a given an image of a person or animal and a series of text message. In general, we see a strong trend of human interaction in some form with all of these implementations.

Additionally, many applications currently exist which have similar functionality to Green Laser, though we know of very few which work in this particular “green” domain. Red Laser is a generic application for scanning barcodes that displays a listing of prices anytime a barcode is scanned [5]. Red Laser’s core contribution was the technology behind retrieving and analyzing images from the iPhone such that if a barcode is in an image, the application can extract the UPC code and do a search based on that code. We built Green Laser off of the same barcode scanning technology present in Red Laser. GoodGuide also makes use of the Red Laser barcode-scanning technology, and additionally displays a listing of (in general): green ratings, environmental/social facts, nutritional information, and user ratings of a product or company [7]. We save a deeper analysis of GoodGuide in contrast to our application for the Results section. Shop Savvy is another utility, which is able to scan barcodes, but is not currently available for license to other application developers. Shop Savvy is able to display many metrics, such as nearby locations selling a scanned product and the price point for that product, as well as online prices and user feedback for various sets of products.

III. IMPLEMENTATION

During the initial development of Green Laser we found that our assumptions on how to present information to users about products and companies were, in some ways, already existing in the marketplace or irrelevant to a user’s real needs. A study shown in [8] found that our initial notion that users would be interested in searching for green data via a text-based search or category-structure (i.e. displayed in a tree-based fashion) were not productive uses as judged by participants’ time. In general [8] found that scanning barcodes was much more time efficient and preferred by end-users as opposed to manually searching through a listing of products stored in various categories. Further, our original implementation of Green Laser was formed out of a project, The Social Cost Tracker, which consisted of an iPhone application that displayed extremely fine-grained details pertaining to a company in the

form of text-based information, video clips and images. Further analysis of this interface found that giving such a fine-grained interpretation of a product or company would ultimately mean that our dataset would be limited to those companies and products which we could create such content for. After initially attempting this approach, we found that content creation was much more difficult and tedious than we had hoped. In light of this, we redirected our efforts to aggregating information from freely available sources found on the net. Therefore, we present our methodology for building Green Laser by means of content aggregation as opposed to content creation.

A. Database Architecture

The backend component to Green Laser consists of an SQLite relational database. Currently, this database only consists of company and brand information for a given product. We currently serve no product-specific ratings, but have built the functionality out for when we do find such specific ratings. Initially, our database consisted of company or brand listings and a set of corresponding ratings. We assigned a unique company and source identification tag so that we maintained as relational a database as possible for our dataset. Once we compiled all of our sources together we found over 1,000 different product listings and almost 1,500 unique ratings. We acknowledge that there is much room left for this database to grow in order to be able to return results for the majority of items in an average grocery store.

One major issue we had with the SQLite database was the mapping of a brand to a given company. In general, any one company can have a (sometimes quite large) number of brands associated with it. We made use of [9] in order to start creating a mapping scheme between companies and their corresponding brands. To our knowledge, we do not know if any such database is readily available from any other source.

The next issue we ran into when developing our database was in obtaining product-specific ratings. Finding these types of ratings is, in general, a rather difficult task. Energy Star [10] does a very high quality job of listing every product and it’s corresponding ranking compared to their baseline for energy efficiency, however washers and dryers (the largest category for Energy Star ratings) generally do not have barcodes available to be scanned. Energy Star does publish results for many different products, but we are currently not mapping anything with Energy Star’s product information at this time, but are aggregating company information for use in our application.

Overall, our SQLite database consists of companies, ratings and sources, and it has been retrofitted to allow for brand ratings and a relationship between a brand and a given company. Though our database is still relatively small we believe that this is a good starting point for creating such a database that can be used by many different organizations looking to utilize such information for any platform.

B. Application Architecture

There are 3 main components to the Green Laser application. The most important of these components is the barcode scanner technology that allows us to easily interpret image captures from a phone's camera and retrieve the UPC label on any product (under decent lighting conditions). Once we had scanned a barcode, we needed the capability of converting that barcode into a company, product or brand. To do this, we utilized Google's Base, which is a massive listing of items and item information supplied by vendors for any submitted barcode (or product). The third major architecture decision was how to layout the app, and by what methodology, such that users of Green Laser can easily and quickly make use of our app.



Figure 1 - The Green Laser user interface. We see company ratings in blue, brand ratings in green, and the category average for products of this type.

We licensed Red Laser from Occipital (makers of the application). Red Laser comes with an API for scanning barcodes and retrieving all characters/digits within a barcode. Red Laser does this by interfacing with the iPhone's built-in camera on the back and, when developing with the Red Laser SDK, it handles all interfacing between the camera and the barcode scanner. Further, it also allows for the ability to

decide in what orientation the scanner will work and a percentage of the lens (i.e. size of the screen) to use in order to scan a barcode. Of note, Red Laser is one of the highest grossing apps present in Apple's App Store and was the top grossing app for many weeks after its debut on the App Store.

Google's Base is a listing of products and corresponding information about those products (e.g. company, UPC code, price, etc.) freely made available by Google [11]. Base is not a perfect implementation, however. Currently when scanning any UPC code from Pepsi or Coke, incorrect results are returned from Google Base. We believe this has something to do with UPC codes of products whose original packaging has since been removed and the individual items within contain unrecognizable barcodes to Google Base. Our workaround for this issue consisted of storing those barcodes for which we tested and found inconsistencies, and creating a reference table which tries to match a barcode and map it to a product/company in our table. If this operation fails, we then submit a request to Google Base to find our product information.

Google Base parses and returns information in an XML format. One of our rating sources, GoodGuide, uses this method as well, which meant that we had to find some means of easily parsing XML on an iPhone which is not an extremely intuitive process when using Apple's API for this particular type of task. The reason for this is because Apple's API for the iPhone OS is much more restricted than that of the Mac OSX operating system which has many structures built-in for handling such tasks. We found an open-source XML parser that we used to deconstruct XML responses from Google Base in [12]. When we saw that GoodGuide's API was available for the public to utilize, but limited usage to 25 requests per day, we were hesitant to add GoodGuide to our application. Ultimately, we included these ratings to ensure that any information we have available for a product can potentially be at the disposal of our end user, even if the rating is not returned after a given number of uses each day.

Our user interface was the last major component to this application. When deciding on a format to display information for this interface, we decided that normalizing all of our data on a scale of 1 to 5 stars would be the most worthwhile method of visualization for end-users. The logic behind this is that we don't want users to have to analyze different metrics on different scales. We provide links back to every source so that if a user is interested in the original scale (or the rating itself) they can backtrack from our user interface to a particular product/company rating. We also found that we wanted to display not only the ratings for a given product/company, but also the category average for that type of product. As described in the database architecture, we have a category listing which can be a parameter in an SQL statement for calculating the average set of ratings in a given category. We hope that this metric will be more informative in the future as our dataset grows in size to reflect finer grained categories with more ratings within those categories.



Figure 2 – The user interface on Green Laser has the capability of returning many ratings from time-to-time, but in addition, will show slightly more detailed information pertaining to those ratings.

The last item we needed to include in our user interface was a product image, price, description and category. Google Base provides many more metrics, but for our purposes, we chose to just extract those particular values. Figure 1 shows us the user interface of Green Laser in its current state. We can see that a box of Kraft Shells & Cheese was scanned and three company-specific ratings were returned from various Newsweek sources, a brand-specific rating was returned from GoodGuide and the category average for all products in our “Food” category is 4/5 stars.

C. GoodGuide’s Approach

As mentioned previously, Green Laser utilizes GoodGuide’s product and company ratings as well as an aggregate of other sources in order to provide the best analysis of a given product or company. GoodGuide’s approach is to rate every product they possibly can and to publish those individual findings on various mobile platforms and the GoodGuide website. GoodGuide publishes information on many different areas of consumer interest, but focuses on three main niches: groceries (generally organic), children’s toys, and cleaning supplies. GoodGuide tends to minimally offer insight into some of its ratings. As an example, if GoodGuide analyzes a product and decides that product somehow harms the environment, GoodGuide notes on their application/website that harm was done to the environment, but doesn’t offer the detailed reasoning behind this rating (e.g. we know an item might harm the environment, but not the exact chemical that does the damage). To date, they have started releasing some of this information on their website. Additionally, for many products GoodGuide also displays purchasing and nutritional/ingredient information, which we argue is not necessarily worthwhile to consumers who are scanning a barcode with the product in-hand. While we see many merits to GoodGuide’s approach in this space, we wanted to find out if users preferred a more in-depth approach

to understanding a product or a format that can be quickly parsed, as we present in the next section.

IV. EXPERIMENTAL RESULTS

In order to validate the approach to our interface, we decided to compare and contrast our layout with GoodGuide’s. We asked a set of 50 participants whether they liked Green Laser’s user interface or GoodGuide’s, given that we supplied a couple of barcodes that both returned a series of ratings or data on each app. Figure 2 shows the GoodGuide user interface and layout of information corresponding to a scan on a bag of Frito Lay’s potato chips. Our short study concluded that 60% of respondents preferred the Green Laser interface to GoodGuide’s, as shown in Table 1. While we don’t take these findings as statistically significant (we would require a bigger study to make such a claim), we do believe they validate our claim that there is room in the mobile space for an application which aggregates a set of green information and ratings, and we are therefore hopeful about how Green Laser will fare once it is released into the Apple AppStore.

# Participants preferring Green Laser’s User Interface	30 Votes (60%)
# Participants preferring GoodGuide’s User Interface	20 votes (40%)

Table 1 - A survey with 50 participants showed us that GreenLaser was preferred by 60% of our users.

Feedback from our user study indicated that many people preferred the “stars” scale in our application (see Figure 1), as opposed to a concrete number as displayed in GoodGuides. Participants also found that they believed the Green Laser user interface was quicker to read through as opposed to GoodGuides. We also received many passing comments on the color scheme and layout/organization of content within our application.

Users who were more critical of our application indicated that they preferred more details about a product as opposed to an aggregate of information. Participants preferring GoodGuide mentioned multiple times that the lack of any elaboration about the ratings is what they did not like about our application.

V. CONCLUSION

There are a vast number of interesting topics within mobile computing. Engineers can focus on enhancing security, wireless range, functionality or novel applications in the mobile systems space, and we expect this trend to continue well into the future. Green Laser is a product of that trend.

We offered a mobile application, Green Laser, which is geared towards allowing consumers quick and reliable access to green ratings for a variety of companies and brands. It is our belief that by displaying an aggregation of ratings as

opposed to a detailed analysis of a given product, we are able to help end-users make a purchasing decision in a small amount of time. We conducted a small user study comparing Green Laser's and GoodGuide's user interfaces and found that Green Laser was preferred by approximately 60% of our audience. While this statistic doesn't detail an overwhelming interest for an app of this nature, we do believe that we offer a simple, easy means of translating a barcode into a rating between 1 and 5 stars, which will be of use in the marketplace.

As our application enters the iPhone marketplace we intend to track barcodes that do not return ratings, the location of persons using our application and the duration for which each user runs our application. We believe that this set of information (as well as the number of downloads of our application) will help aid us in deciding the next steps for this project in the near future. Future Work

Mapping a barcode to a product-specific rating is our next major step in developing Green Laser. This information will be critical so that consumers, at some point, will be able to see a fine-grained set of ratings that they will be able to compare with a similar product on a nearby shelf while in a store. Our vision is ultimately to have, for any given product, the ability to recommend an item to a consumer that is slightly more "green" (i.e. returns a higher average of ratings) than the item they had originally scanned.

Future upgrades to our app consist of the ability to store results of scans by any given user, as opposed to our application's current implementation without such a capability. We also intend to add the capability to purchase items on Amazon or Google Checkout by supplying links for every product scanned back to either of those two sources.

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