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ORIGINAL ARTICLE

my2cents: enabling research on consumer-product interaction

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Abstract Barcode scanners for smartphones enable mobile product-centric services for consumers. We have developed a mobile app that enables consumers to share their use of and opinions about products with their friends and others. Our goal is to establish a product-centric information stream generated by users to benefit other consumers and retail businesses and to enable large-scale research on consumer-product interaction. This paper describes our approach to create a sustainable service. We report first experiences and an initial evaluation after releasing the app to the public, give an overview over possible business models, and discuss some of the challenges we experienced during implementation.

Keywords Consumers · Products · Retail · Shopping · Barcode scanning · Business model

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1 Introduction

Strategic consumers are on the rise: Consumers gain more influence and power over strategic decisions of business-to-consumer (B2C) companies [1]. Many consumers are aware that their buying decisions directly influence corporate strategies and therefore have more impact on global economy, ecology, and society than, e.g., democratic voting decisions.

Online communities and information services try to satisfy the need of critical consumers for sharing information about companies and their products [2]. Also, blogging—and more recently microblogging—about products and brands is becoming popular among consumers. B2C companies begin to understand the impact of critical consumers talking about their products and try to capture the business value in it. Also in the marketing industry, a shift from traditional advertising toward conversational marketing can be observed. Electronic or digital word-of-mouth is becoming an important trend in marketing [3–5].

As consumer internet activities shift from the web to mobile, new opportunities to interact with products emerge using a unique product identifier, i.e., a global trade identification number (GTIN) like the EAN or UPC. The popularity of barcode scanning apps, which use the mobile phone camera and image recognition algorithms to recognize the GTIN, shows that mobile and product-centric services are valuable for consumers [14].

The fast deployment of mobile apps through app stores allows user studies in the field of pervasive and ubiquitous computing on a previously unavailable scale [40]. We have developed my2cents,[1] a mobile app for sharing opinions about retail products with friends and other consumers. The

[1] http://my2cents.mobi.

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app combines the concept of social objects with mobile product identification. Our goal is to establish a consumer-generated, product-centric information stream to benefit both consumers and retail businesses and to enable large-scale research on consumer-product interaction.

Consumers benefit from shared product experiences to learn about products and make better buying decisions. In addition, an innovative and immediate feedback channel from consumers to businesses is established. Brand owners and retail companies benefit from product-related consumer opinions and can enter in a real-time dialogue about their products with potential and critical customers. In the long run, a continuous integration of consumer feedback will lead to higher market transparency and better products.

We introduced the concept and described the development of the app with implementation details in [13]. This paper gives an overview of the current market situation and related work. We describe our approach and possible business models. In addition, we describe observed usage scenarios, present a short evaluation with user tests, and discuss two issues we consider most relevant: how to integrate barcode scanning and problems with gathering relevant and accurate product information.

2 Market situation

Many barcode scanning applications on the market compete for mobile shoppers' attention. Most of these apps focus on price comparison, some address consumers concerned about health and sustainability, and, more recently, apps focus on social interaction and allow users to recommend products to friends and followers.

2.1 Mobile price comparison

ShopSavvy and Compare Everywhere were among the first mobile applications available for the public to offer barcode scanning on smartphones for price comparison. Both apps initiated as winners of the first Android app contest in 2008 and build on the freely available ZXing barcode scanner library [23, 24]. In late 2010, ShopSavvy had about 5 million users which generated up to 100,000 scans per day. RedLaser is a barcode reader app for the iPhone which sold about 2 million apps for $2 each and was a longtime top ten paid app on the iTunes App Store. The app has been sold to eBay for a reported price of $10M [25].

Scandit and Bakodo offer price comparison for the U.S. Market with improved barcode recognition and a better user experience [36, 37]. Localized variants of price comparison exist, e.g., in Germany with barcoo and woabi, or in France with lynkee. The Swiss startup Kooaba developed a system to identify products by taking a picture of the product or the package, a concept that has also been implemented by Google Shopper [26, 27].

2.2 Health and sustainability

Other apps are targeted directly at critical consumers and provide product information about nutrition, health, or sustainability: The iPhone app for the Swiss independent product information service codecheck.info immediately gained 100k downloads in the 1 days after release [28]. The comparable app of by Goodguide in the U.S. Received $3.7M of venture capital funding [29] and in Germany das-ist-drin.de offers a similar app.

2.3 Social interaction

StickyBits is a mobile app to stick digital information to barcodes [22]. They started off selling barcode stickers to attach to arbitrary objects. Later, they announced a deal with a large retail company to augment soft drink bottles and cans with digital content connected to the product's barcode [30]. Recently, StickyBits shifted toward helping businesses to promote their products and offering rewards like give-away products for users who scan products. They also integrated Facebook and Twitter to authenticate users and make them share product interactions with their social networks.

Hatena Monolith is a Japanese app offering a game-like approach to product scanning: users who scan product barcodes can share things they like with others, e.g., on Twitter. Their actions are rewarded with medals and virtual money [31]. The location-based community MyTown announced to offer product checkins together with a large retailer [32]. Barcode Hero and myshopanion also focus on social shopping features like sharing product recommendations with friends on Twitter or Facebook [38, 39].

The development of the market is very dynamic. After RedLaser and ShopSavvy opened their barcode scanning libraries to third party developers, a wide variety of smaller apps for mobile product interaction can be expected. The most recent evolution are apps focussing on social interaction with products that are already used in the United States and Japan. We want to focus on this area and address the needs of European consumers.

3 Related work

Mobile product interaction has also been a topic in research for many years: Brody and Gottsman already presented a mobile application for comparing prices using the phone's camera to scan product barcodes in 1999 [6]. Adelmann and others developed a toolkit for recognizing product

barcodes with phone cameras [7]. Novak described a mobile consumer support system in an augmented supermarket based on RFID tagged products [8]. Resatsch et al. conducted a thorough evaluation of the user acceptance of mobile product information systems based on RFID [9]. Reischach et al. developed a mobile product recommendation system for consumers that interacts with NFC tags on products [10]. Reischach et al. have also compared different product identification techniques [11] and review modalities for mobile phones [12] and conducted a comparison on mobile barcode scanner software implementations [16].

Large-scale user studies based on mobile apps are a new and promising field in pervasive and ubiquitous computing [35]. Scientific work about the usage of barcode scanning apps and their effect on consumer behavior in the real world is not yet available. One reason might be that consumer-generated data from existing services is rarely available for the scientific community to analyze and user studies are hard to conduct in cooperation with commercial services.

Our goal is to establish an open and transparent stream of consumer-product interactions which is available and useful for both consumers and researchers. We want to share our results and enable more research on this scale.

4 Our approach

Our approach is to offer an app for consumers to share their use and opinion about products within their social networks. Users should be able to quickly identify a product, access comments, and ratings from friends and other consumers and post their own opinion to share it with others.

We implement a basic concept, distribute the apps, and operate the server backend. We evaluate usage from server logs and want to find out more about users' intentions and expectations with user tests. This user-centered approach helps us to develop closely related to users' actual needs. We focus on software development and on providing a great mobile user experience. We also aim to cooperate with technology partners and external services for product information, user authentication, and the exchange of consumer-generated data.

4.1 General concept

Scanning a product already indicates that the user is interested in this product. This is the most basic form of interaction. Furthermore, users can also share their opinion about a product. This should be as easy as possible, e.g., after scanning the barcode one click should suffice to show "I like or dislike this product." Writing a text comment on a product should also be very easy for the consumer.

Users should also be able to share their own product experience with others on microblogging sites and social networks like Twitter or Facebook. Our goal is to enable dialogues between friends and other consumers about products on the go. This can be targeted at recommendations and suggestions or also be only for mere satisfaction and fun to express thoughts about products and share them with others. Posting comments to popular sites also enables us to include backlinks to the app's website to attract more users and exploit the viral effect of online social networks.

Figure 1 shows the general concept of the smartphone app: First, users scan a product's barcode to identify the product. Second, they can see some basic product information to confirm the correct identification of the product and see what their friends and others think about the product. If others have left comments, they can also read these comments. Third, users can state their own opinion, either by pressing a like or dislike button, or by entering a short text comment. Users can identify themselves using an existing social network account. Comments can also be shared with others by distributing them on social networks or microblogging sites.

4.2 Features

4.2.1 Identify a product and get opinions

The mobile application uses the smartphone's camera to read the product's barcode and capture the product's GTIN. This GTIN is used to query a web service for information related to the product. The web service queries an internal database and several external resources for basic product information (e.g., name, manufacturer, and image) which can be returned to the mobile app to confirm the correct identification of the product for the user. Users can read

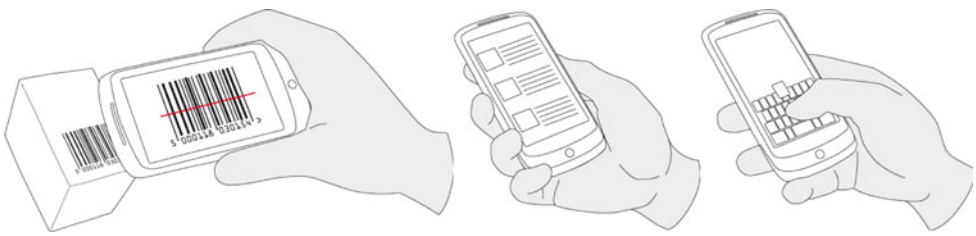


Fig. 1 Our concept: Scan a product's barcode, read what others have said, share your own opinion

other users comments and see the overall rating for a product.

Successful barcode scanning is subject to lighting conditions and the surface of the package where the barcode is printed. When scanning fails, a fallback to manual input is provided: Users can also enter the product's barcode number by typing it in.

4.2.2 *Share your opinion*

Users can rate a scanned product with a binary rating by simply clicking one of two buttons showing thumbs up or thumbs down. Users can also enter and submit a textual comment for a product.

4.2.3 *Authenticate*

Users can login with an existing account for a social network, e.g., Twitter or Facebook. When logged in, comments are not posted anonymously but are mapped to the account's profile and displayed with the user's name and avatar image. Using these existing services as identity providers facilitates authentication, and users can also share their comments with their social network. When doing so, a backlink to the app's web page showing the product and all related comments is added to the comment.

4.2.4 *Follow other users and your friends*

On the website and from within the mobile app, users can follow a live stream of comments submitted by other users. Logged in users can highlight comments by friends and peers. Clicking on comments shows the product with all related comments, clicking on a username shows a list of products a user has scanned, likes or dislikes, or has commented on. Product categories allow a browsing through related products.

4.2.5 *Track your products*

A history feature in the mobile app allows users to see a list of the products they have scanned or visited before. Users can also choose to receive notifications when others are commenting on products they have previously commented on. This notification can be done via email, text message, direct message on the social network, or push notifications to the smartphone.

4.3 Implementation

Figure 2 shows the business network in which we implement the proposed concept. The core of our work are the mobile app, the server backend, and the data analysis: We develop the mobile apps for different smartphone operating systems and deploy them. We also develop and operate the server backend and analyze the consumer-generated information stream from which we generate reports and visualizations for business customers.

External partners provide the barcode scanning technology and the product information needed to identify the product. We also use external services to authenticate users.

4.3.1 *Barcode scanning*

Several different libraries for barcode scanning exist. On Android, we use the freely available ZXing barcode scanner library for product identification [24]. On the iPhone, we first used the RedLaser barcode scanning library but replaced it later with ScanDK, a better and

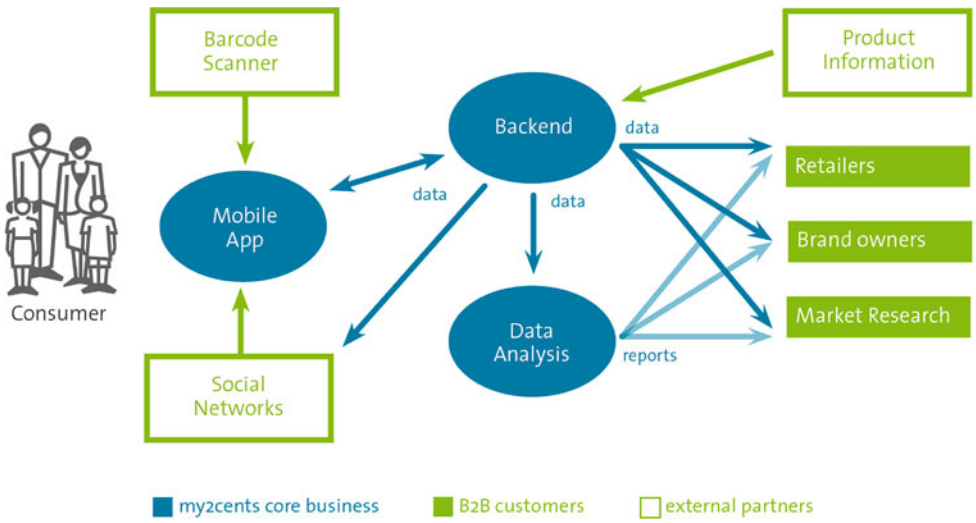


Fig. 2 Business network

faster barcode scanning solution developed by Mirasense, a Swiss startup [33]. Another interesting option is the open source library ZBar, which implements a cross-platform barcode reader [34]. However, ZBar needs focussed images and does not work well with fixed focus cameras of older smartphones like the iPhone 3G.

4.3.2 Product information

Basic product information (i.e., the name, image, category, and manufacturer of the product) is retrieved from various online sources to enable product identification for the user. Our goal is to provide a fast and accurate response and to recognize as many retail products with a barcode as possible. As there is no authoritative source of product information for retail products, we use several different databases and web services to retrieve product information, e.g., Amazon eCommerce web service, codecheck.info, UPC database, OpenEAN database, affili.net. The information is aggregated, and we try to provide the most accurate product information for the user.

Currently, we are ordering the information sources by reliability in a very static way, i.e., just by looking at the data returned for selected products. We are working on implementing a user feedback system to measure and automatically adjust the reliability of information sources and—if necessary—to make the users correct a wrong product information or add missing information for an unknown product.

4.3.3 User authentication

We use external services as identity providers. Users can authenticate using existing accounts, e.g., Twitter or Facebook. Other communities and services can be integrated easily. The accounts and services used for authentication can also be used to distribute user contributions and allow users to share their products with their friends and followers. In addition, viral effects on the social networks can make scanned products and also my2cents more popular.

4.3.4 Software development

The application consists of a web service and several mobile client apps. The server backend has been implemented using the Ruby on Rails web programming framework. It provides a public RESTful API to access product information and to access and post user comments and ratings.

The backend also provides a simple web interface which can be used with standard web browsers and also a lot of mobile web browsers. The smartphone app has been developed for Android and iPhone platforms. The first version of the app has been released on the Android market in April 2010. Figure 3 shows some screenshots of the Android app. Figure 4 shows pictures of using the app with a product. The iPhone version has been released in September 2010. The current status of the app and consumer comments can be seen on the app's website.

5 Business model

The usage of the app results in a user-generated, product-centric information stream which can be compared to the stream provided by Twitter and other microblogging systems or social networks. The app should always be free and attractive for consumers, and all data should be freely available for research. To be economically sustainable, operation of the service also needs to generate some revenue. However, the app should also provide independent and trusted product information.

We discussed different business models with representatives from retail companies and brand owners, consumer communities and venture capital firms and identified several options to generate revenue from a consumer-generated, product-centric information stream. In the following, we give an overview over possible business models that could also be combined.

5.1 Product-centric customer relationship management

Available geo-location information in mobile phones has been an important driver for pervasive computing with a wide range of location-based services becoming popular on smartphones. Some location-based services like plazes, Foursquare, GoWalla, or Friendticker, have shown that people like to socialize around specific locations like, e.g., restaurants, bars, etc. With these apps, users can "check in" with specific locations and distribute events and comments related to these locations to their social networks letting their friends know where they are and what they think about a place.

With simple product identification for smartphones, this concept can be transferred to retail products. Businesses can benefit from this approach by implementing a social customer relationship management system around their products at low costs. Brand owners and retailers could get in contact with customers interested in their products in real-time and be charged for a privileged access to consumers and their opinions. A comparable business model for business locations has been implemented by the Berlin-based startup Friendticker [21].

5.2 Marketing

All comments on a specific brand or a collection of products can be collected and provided to the brand owner as





Fig. 3 Screenshots of the Android app

Fig. 4 Using the Android app

consumer feedback for marketing, e.g., as advertising content for digital signage at the point of sale.

Given that the user comments are not anonymous but related to a social network profile with a username and avatar image, user comments can also make very valuable user testimonials in marketing campaigns.

5.3 Market research

Brand owners have a strong interest to know more about the perception of their brand. The steering of the brand image and the resulting brand recognition are activities strongly related to marketing and subject to extensive market research. The market for behavioral studies and brand tracking is expected to reach $1.5B in 2010 [20].

Comments and user opinions about products can be used for market research, trend analysis, and brand tracking [29]. Consumer behavior and feedback can be monitored in real-time and location-based, providing valuable input for strategic decisions. Reactions to events and other external factors affecting consumer opinions can be monitored.

Opinion mining and sentiment analysis can be used to automatically derive a measurement for consumer's perception of certain products [17, 18]. As consumers authenticate themselves using existing social network accounts to personalize their comments and share them precise consumer profiling for market research is possible—given of course that privacy considerations allow access to consumer profiles.

5.4 Advertising

With the acquisition of AdMob by Google and the introduction of iAd by Apple, the market for mobile advertising is estimated to reach $1B soon and is growing fast [15].

The proposed system can be used for heavily targeted advertising in the retail business: When scanning a product, the user shows interest in this specific product and is probably interested in comparable products or cross-selling. According to mobile marketing experts, a price for thousand ad views (CPM) of $10–15 is realistic. Additional revenue can be generated with affiliate links.

ShopSavvy introduced a product-centric advertising platform in early 2010. With 5M users of their own app and over 100 licensees of their barcode scanning framework, they hope to generate about 10M product scans per day. ShopSavvy is earning money by auctioning away aggregated events combining the user's location and the scanned product barcode for specific products or product categories.

5.5 White label

If not operated as an independent service, the app can also be licensed to and customized for existing consumer communities, opinion sites with product databases, or brand owners and retail companies. The customized app carries the corporate identity of the customer and is also distributed in the customer's name through app stores or can be downloaded from the customer's website. The customer provides and has complete control over the available and presented product information. Also, the processing and distribution of consumer comments can be controlled by the customer. Consumer comments collected by the app can be used for advertising, e.g., with digital signage at the point of sale, as testimonials in marketing campaigns, or analyzed for market research.

The core benefits for business customers are:

- Costs for market research are reduced: According to marketing experts, in traditional market research, a consumer survey costs about $10 per person. The app can provide one consumer's opinion at an estimated $0.5 resulting in a cost reduction of 95%.[2]
- Tracking of brand recognition and consumer trends, sentiment analysis, and conversational marketing are enabled at low costs.
- The brand is present in mobile and social media with a tangible added value for the business.
- Cross-selling mobile advertising and coupons within one brand are possible: During a scanning process at the point of sale, advertising for a related product can be displayed on the phone (e.g., if a consumer scans cereals, he/she gets an advertising message for yoghurt on his phone. This could also be combined with a digital coupon, which can be redeemed at the checkout right away).
- Large retailers can use the app to supplement existing loyalty schemes, e.g., customer loyalty cards or collecting points for shopping.

6 Evaluation

6.1 User adoption

Since the release of the Android version on April 23, 2010, the app was installed 2,370 times with about 30% active installs. Users generated 39,649 product requests on the server backend for 6,269 different products and left 1,726 comments of which 671 or 38.9% came from authenticated users.

6.2 User feedback

Android users have rated the app 37 times with an average rating of 3.65 corresponding to 3.5 out of 5 stars. The app

[2] Calculation based on an app generating 250 user comments per day and running for 3 years.

has received 19 comments from users: 12 in the English Android market and 7 in the German Android market. While German comments are rather positive, the English comments are more diverse. Many users suggested features and improvements of which some will be considered in the next development iterations.[3]

6.3 Usage scenarios

From the user activity and feedback, we could derive the following dominant usage scenarios:

- Communicate product experience either during or directly after a product use.
- Express yourself, describe yourself by what product you use or want to have.
- Receive information about a product while or before buying it at the point of sale.
- Ask questions about products of interest.
- Reply to comments or chat about products other users have commented on.

6.4 Usability tests

In order to find problems with the usability of the mobile apps and the website, we conducted tests with a few users following a do-it-yourself approach to finding and fixing usability problems as proposed by [12]. The tests were not meant as a user study. Instead, the only goal of these usability tests was to get feedback on our implementation of the user interface answering questions like: Is the app easy to use? Can users achieve relevant goals when using the app, e.g., give a comment on a product?

We invited three users who had never used the app before. The users were selected using postings on craigslist, Twitter and Facebook and were paid for their effort. The only condition was that they owned either an Android phone or an iPhone.

The users were presented with a user posting a product comment on Twitter including a link back to the app's website. They were asked to visit the website, install the app, and work on several tasks. Users were asked to talk out loud what they were thinking during usage of the app. The phone screen was filmed with a camera mounted on a flexible rack which could be held together with the smartphone so that the screen was always visible. Video and audio were recorded and transmitted to an observer room where the development team was watching and listening to the users working on the tasks.

In the tests, we learned about several problems with our implementation of the iPhone user interface. For example, we found out that users often logged out accidentally right after logging in because of misleading options on the screen. Also, the mobile app seemed not to be easy to find on the website. The observed problems were fixed before the release of the iPhone app, and we are planning to repeat the user tests on a regular basis.

7 Discussion

7.1 Barcode scanning

Despite recent advances to better recognition algorithms and improvements in resolution, speed, and quality of smartphone cameras, barcode scanning with phones is still a cumbersome and error-prone process. We have found that the last generation of barcode recognition software provides a near 100% accuracy. However, some users still experience problems under certain circumstances.

From a user perspective, instead of scanning the same barcode many times with different applications to get different types of product information, it probably makes more sense to scan a barcode only once and then use several different information services for the same product, e.g., first receive a price comparison, then recommendations from friends, reviews from experts, and finally where to get the product nearby.

In the future, the functionality of scanning a barcode will eventually go down to the level of the smartphone operating system, i.e., the operating system providing barcode scanning events for applications comparable to providing location information for applications now.

7.2 Product information

Of the 4,796 products, more than 68% (3,281) could be identified, i.e., one of the product information services returned a product name for the requested GTIN. Of the products that were identified, 26% have received comments from users compared with only 11% of those products that could not be recognized. A reliable and correct identification of the product seems to improve the rate of user contributions.

Accuracy of product information varies a lot over different product information sources, countries, and product categories, e.g., information from Amazon is very accurate for books and other media, but often provides wrong results for groceries in Europe. Furthermore, Amazon's terms of service do not allow the use of content "in connection with any site or application designed or intended for use with a mobile device" without an explicit approval [19]. We have asked Amazon for an approval but never received any answer. In contrast, product information from codecheck.info has proven to be very accurate for groceries in

[3] Numbers from the Android market statistics 29 July 2010.

the German speaking market. User comments and ratings from the different Android markets indicate that the app is perceived to perform better in German speaking countries.

While some retail companies provide their product catalogues, e.g., for download or via affiliate networks, other databases such as the ones of some retailers or data pools following the global data synchronization network standard are not yet accessible for us. Many large companies and organizations still regard even very basic product information as proprietary and for internal supply-chain operations only. We believe that with mobile product information services, the availability of basic product information will make a difference in how consumers perceive a brand and its products.

7.3 Conclusions and outlook

Our vision is to establish a consumer-generated, product-centric information stream for a wide range of products. We want to implement a sustainable, consumer-friendly and transparent business model based on this information stream and provide an open and flexible platform for in-depth analysis of consumer-generated data and for conducting user studies and experiments.

We have discussed the opportunities of a product-centric information stream and the benefits for consumers, businesses, and research. We have shown our approach to an implementation and described several possible revenue streams.

We believe that mobile phones will enable consumer interactions with products and that these interactions will improve the quality of life: Consumers will finally get the products they want, after businesses listened to their feedback for years and improved the products to reach a higher level of customer satisfaction.

Besides further improvements on the usability of the app and better product recognition, we also want to analyze the collected data. Interesting questions for future analysis include:

- Which products and product categories are scanned?
- Which products and product categories are most commented on?
- Which products and product-related topics are currently trending?
- Does it make sense to apply collaborative filtering techniques (users who liked this product also liked …)?
- Can we measure consumer reactions to marketing efforts, e.g. advertising campaigns?
- Can we recognize negative opinions and trends like low consumer satisfaction or quality problems with products?

We consider my2cents a powerful research tool to acquire real data about consumer-product interaction which has not been available for research before.

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