On Using Mobile Crowdsourcing for Timely Information Solicitation and Sharing of Prices

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Abstract: The increase in goods prices year after year has directly affected consumer expenditures. Survey from a number of countries showed that the average household expenditures had also increased, notably in the past two years. One way to alleviate the impact of the rise in goods prices is by being more selective in buying the items. Being selective means buying the items at the stores that offer the lowest prices. To do that, a mechanism to compare the prices of items between stores is needed, in which, the local pricewatch information solicitation and sharing (LoPrice) model was proposed. The challenge to the design of such model is in the choice of suitable approach for collecting the information on prices from different stores in a timely manner. In this paper, mobile crowdsourcing is proposed to be the approach that is able to address the challenge. Review on existing price comparison applications, including their advantages and disadvantages is also included. An exploratory survey was also performed, which revealed that the use of mobile crowdsourcing is able to provide timely information solicitation and sharing of prices.

1 INTRODUCTION

The ever increasing price of goods has directly affected the household expenditures. This was proven by facts and figures from a number of surveys performed by local authorities, which showed increases in the average monthly household expenditures. In Malaysia, finding from the survey performed by the Department of Statistics, which is performed every five years, showed that the average household expenditures increased by 12.1% in five years time from 2004/2005 to 2009/2010. A report on consumer expenditure survey by US Bureau of Labor Statistics also showed an increase of 3.5% in consumer spending in 2012, and this was the second consecutive year that expenditures increased (of Labor Statistics', 2014). In Singapore, the consumer price index (CPI) for general household rose by 4.6% for the full year of 2012 and by 2.4% for the full year of 2013.

Even though it is generally admitted that the increase of prices in household items is just unavoidable, there should still be ways to 'live with it' in such a way that the financial impact on consumers, in particular the breadwinners, can be alleviated. One of the ways is by being more selective in buying the items, with regard to the prices. Being selective here means, rather than simply buying an item, we first compare the price of the item between one store and another. It is not uncommon that different stores offer different prices for the same item of the same brand. This is probably part of the marketing strategies and we can take advantage of the strategy by being able to buy the item at the lowest price.

The challenge lies in providing the means to enable such comparison to be made *conveniently* and *timely*. Convenient means being able to perform the comparison without having to leave the comfort of one's house or office and without having to physically move from one store to another to perform the comparison (and returned to an earlier store that offers the lowest price). It will be best if the comparison can be performed before they even leave the house for the shopping trip. It can also help in planning the shopping route. Timely means being able to obtain the latest and current price update and being kept informed when the price is no longer valid.

In this paper, we propose the use of *mobile crowdsourcing* approach in obtaining timely information on the prices of items from the users. Mobile crowdsourcing is a form of crowdsourcing in which the initiator sends a task or makes available a task for voluntary undertaking by using mobile phones (Väätäjä et al., 2011). The tasks are received or accessed through mobile phones and completed tasks are also

submitted using mobile phones.

In the next section, a review is made on a number of existing price comparison applications globally as well as locally (in Malaysia). In section 3, the overview of our proposed solution, which is a model for crowdsourcing information on prices of items from users through their mobile devices, is explained. In section 4, analysis results of an exploratory survey done to determine the potential application of mobile crowdsourcing in the construction of the LoPrice model is presented. Finally, section 5 concludes the paper.

2 CURRENT APPROACH

Traditionally, price comparison of items was done by going to each store, which was time consuming and taxing. It could also be done by browsing promotional pamphlets sent to mailboxes. However, comparison was difficult to be made this way because different pamphlets usually featured different items on sale and not all stores provided the pamphlets. With the advancement in the internet technology, stores were seen to start having their online websites. Again, not all items were featured on the websites and comparison of prices required users to surf from one website to another. This had therefore lead to the development of websites and applications that allowed comparison of prices from a number of different stores to be made, which will be discussed next.

2.1 Price Comparison Applications

Many crowdsourcing applications have been developed as web-based and mobile, nine of which were included in our review. These are CartCrunch (CartCrunch, 2014), ShopSavvy (ShopSavvy, 2014), Smoopa Shopping (Smoopa, 2014), Leclerc (Leclerc, 2014), ideola Price Comparison (Ideola, 2014), Grocery King Shopping List (GroceryKing, 2014), HuMuch (HuMuch, 2014), 1pengguna (KPDNKK, 2014) and Yellavia (Yellavia, 2014). Reasons for inclusion were

- these applications offer price comparison feature
- items under comparison include household items

CartCrunch is a location-dependent application. It has the ability to scan information on items via an image of a receipt. It has the feature that can find the best prices of every item purchased on the receipt and provides the store location information of the items.

Most of the mobile applications such as CartCrunch, ShopSavvy, Smoopa Shopping, Leclerc

and ideola Price Comparison read bar code in order to obtain items information easily. However, user still needs to enter the price and store information of each item. Leclerc is an application developed for the Leclerc Company to ensure that this company always provides the best price to its customers. Therefore, it only works if the price of its own product is cheaper than the other stores.

Meanwhile, Grocery King Shopping List (GroceryKing, 2014) is the only application that provides *sync* feature that enables users to share or email their shopping list with family and friends.

HuMuch (HuMuch, 2014), is an example of web-based application that performs similar functionalities. Since it is a web-based application, users need to become a member in order to use it. However, we are not able to explore HuMuch further as it does not support locations outside the United States.

Particularly in Malaysia, two such web-based applications are found, Yellavia (Yellavia, 2014) and 1pengguna (KPDNKK, 2014). Our experience with Yellavia found that the prices shown were outdated by a year or more! 1pengguna is a portal developed by the government of Malaysia to provide price information on 105 consumer products. Information is provided by a group of *agent*s, which are special members appointed by the government to provide the product details. These agents are supposed to update the information daily before 2 p.m. However, there is no mechanism to verify whether or not the price is updated because the application only displays the current date read from the system. Our experience using the application also showed that the information on prices of items were only available for a very limited number of areas.

It is believed that one of the reasons that caused the slow update of information is the fact that the information came from only a few limited sources (KPDNKK, 2014). However, as can be seen in the case of (Yellavia, 2014), crowdsourcing alone is not able to sustain regular and continuous incoming information as users need personal computers or laptops to access the web-based portals.

To address the problems above, we are proposing the use of mobile crowdsourcing in the solicitation of information on prices of items through the development of the LoPrice model. With mobile crowdsourcing, the task of entering information is done using hand held mobile phones or devices through mobile applications. This will expedite the information solicitation process and allows for immediate update of information.

3 LoPrice MODEL

Though being coined only recently (Howe, 2006), the essence of crowdsourcing, that is, information sharing, is not a new practice. People have been naturally sharing and contributing ideas in solving problems for ages. Traditionally, the people involved in the practice comprised a group of those who were within a close physical and geographical contact with each other. However, the advances in the information and communication technology (ICT) have become the catalyst that extends the practice beyond physical and geographical boundaries.

Thus, crowdsourcing has been defined in a more specific tone that suits its currentness with a number of characteristics attached to it. In their work, Estellés-Arolas and de Guevara (2012) listed the following as the characteristics of crowdsourcing based on their study on a number of existing crowdsourcing applications.

1. Clearly defined crowd
2. Clear goal
3. Recompense received by crowd
4. Clear crowdsourcer
5. Crowdsourcer compensation
6. Online assignment
7. Open call
8. Uses internet

Amongst the benefits of crowdsourcing is the timeliness of the information obtained (Zheng, 2011). Timeliness means being able to be updated about something when it is still happening and being informed when it is obsolete. This is important, especially in the context of the prices of items, which change regularly due to policies by the government or authorised bodies, promotion and marketing strategy. This can only be achieved by obtaining the information from multiple sources, that is, the crowd, through crowdsourcing.

Figure 1 showed the overview of the LoPrice model that utilises crowdsourcing as its main source of information on prices of items. The objective of the model is to enable timely comparison items prices to be made between different stores. In other words, by using the model that is manifested in the form of a mobile application, users are able to compare the prices of the items that they want to buy prior to leaving their houses. They are therefore able to know which store can offer them the lowest prices for the items that they want to buy. They can straightaway go to the store, hence saving their time, effort and of course, money.

Figure 1: The overview of the LoPrice model.

To achieve the objective, it is crucial to have up-to-date information on prices of items and due to the frequency of price changes and the number of stores, it is difficult to rely on one source of information for this or even a number of selected sources as seen in (KPDNKK, 2014). Hence, the most suitable approach to obtain up-to-date information on prices that is able to catch up with the challenges is by soliciting it from the crowd through their mobile phones or devices. The information shared includes item price, item detail, its location (store) and duration of which the shared price is valid (if known) as shown in Figure 1.

Based on the characteristics of crowdsourcing extracted in (Estellés-Arolas and de Guevara, 2012) above, the LoPrice model has all the characteristics except the fourth and fifth characteristics. We do not foresee this as a threat because the LoPrice model is a research in progress and is therefore not owned by any crowdsourcer yet.

4 EXPLORATORY SURVEY

On top of the justification given above on the suitability of mobile crowdsourcing to be used in the LoPrice model, a survey was also performed to explore the potential of using mobile crowdsourcing in the LoPrice model from the perspective of its users. The objectives of the survey was to identify the potential of using mobile crowdsourcing in information solicitation of item prices. Four factors were identified to be contributing to the potential of using mobile crowdsourcing as shown in Figure 2. The survey questions were
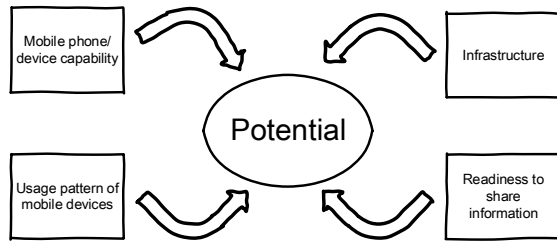
designed according to these factors.

Figure 2: Architectural concept of the model.

There was a total of 18 questions in the questionnaire, seven of which were demographics questions and are not discussed in this paper. The remaining 11 questions were grouped according to the four factors shown in Figure 2 and listed below.

- Mobile phone/device capability
  8. Mobile phone/device availability
  9. Device capability to access the internet
  10. Mobile phone/device capability to take photo
- Mobile phone usage pattern
  11. Mobile phone/device availability during shopping trip
  12. Mobile phone/device accessibility during shopping trip
  13. Hours spend daily accessing the internet and/or mobile applications
- Infrastructure
  14. Type of mobile plan subscription
  15. Network availability (referring to internet accessibility)
- Readiness to share information
  16. Photo sharing through mobile phone/device
  17. Current practice in sharing information on low prices of items with others
  18. Opinion about sharing information on low prices of items with others

Prior to the actual distribution of the questionnaire, a pilot test was performed on the final draft of the questionnaire. The aim of the pilot test was to identify problems with regard to the clarity and understanding of the questions asked. A total of ten respondents participated in the pilot test. Each respondent answered the questionnaire one at a time in the presence of the researcher. As a result of the pilot testing, a number of problems with regards to the clarity of the questions asked were identified and rectified. Consequently, we experienced a smooth questionnaire answering sessions with hardly any questions asked during the actual survey despite answering them at the booths with the presence of the researchers.

4.1 Survey Results

The questionnaires were distributed to the visitors of the Universiti Tenaga Nasional Research Exhibition (UNIREX) 2014 and International Invention, Innovation and Technology Exhibition (ITEX) 2014, both held in Malaysia. Additionally, online version of the questionnaire was also prepared. At the end of the survey, a total of 138 responses were received consisting of 74 (53.62%) hard copy responses and 64 (46.38%) online responses. Prior to analysis, three hard copy responses had to be excluded due to incomplete information.

Descriptive statistics was used in analysing the results. Table 1 to Table 11 below show the results of the questions listed above.

Table 1: Question 8 - Possession of mobile phone/device.

Answer	Percentage
Possess mobile phone/device	100%
Do not possess mobile phone/device	0%

Table 2: Question 9 - Ability to access internet using mobile phone/device.

Answer	Percentage
Can access	97.04%
Cannot access	2.96%

Table 3: Question 10 - Mobile phone/device capability to take photo.

Answer	Percentage
Can take photo	97.73%
Cannot take photo	2.27%

Table 4: Question 11 - Bringing mobile phone during shopping trip.

Answer	Percentage
Yes	90.91%
Sometimes	6.82%
No	2.27%

Table 5: Question 12 - Chance to use mobile phone/device during shopping.

Answer	Percentage
All the time	16.15%
Almost all the time	20.77%
Sometimes	54.62%
Almost never	6.92%
Never	1.54%

4.2 Discussion

From the analyses performed on the results obtained, the following findings were made.

Table 6: Question 13 - Time spent accessing internet/applications through mobile phone.

Answer	Percentage
Less than 2 hours	26.52%
Between 2 and 4 hours	36.36%
Between 4 and 6 hours	24.24%
Between 6 and 8 hours	7.58%
More than 8 hours	5.30%

Table 7: Question 14 - Subscription type.

Answer	Percentage
Prepaid	26.52%
Post-paid with mobile data plan	66.67%
Post-paid without mobile data plan	6.82%

Table 8: Question 15 - Internet accessibility due to network problem.

Answer	Percentage
All the time	0%
Almost all the time	8.33%
Sometimes	77.27%
Almost never	12.12%
Never	2.27%

Table 9: Question 16 - Frequency of sharing photos with others.

Answer	Percentage
All the time	10.08%
Often	24.03%
As needed	48.84%
Hardly	13.95%
Never	3.10%

Table 10: Question 17 - Practice in sharing information on prices.

Answer	Percentage
Yes	40.91%
Sometimes	49.24%
No	10.00%

Table 11: Question 18 -Willingness to share information on prices.

Answer	Percentage
Yes	70.45%
Maybe	26.52%
No	3.03%

4.2.1 Mobile Phone/Device Capability

As can be seen from the results presented in subsection 4.1 above, all our respondents have mobile phones or devices. Though this is probably a well known and well accepted fact, the result obtained from the survey helps to strengthen the claim made on this. Furthermore, 97.04% of these mobile phone holders are able to access the internet and applications using their mobile phones or devices. This means that their mobile phones and devices have the capability to do so.

With regard to mobile phone or device capability too, 97.73% of them have the feature that enables them to take photo using the phones or devices. Phones possession, internet accessibility and phones capability are the enabling technologies to the LoPrice model. Therefore, as far the devices availability, internet accessibility and capability are concerned, they have already had the technologies required by the LoPrice model. This enables the use of the application instantiated by the model without much problem.

4.2.2 Mobile Usage Pattern

To be able to share information on prices of items, it is important to understand the way they use their mobile phones or devices. Result from our survey showed that 97.73% of them bring their mobile phones or devices with them whenever they go for their shopping trips, with most of them are able to use their phones or devices during the shopping trips. Only a very small portion of them did not have the chance to use the phone during their shopping trips (2.27%).

In term of the time spent browsing the internet and accessing mobile applications, it was found that majority of the respondents are accessing them between two and four hours a day, which, in our opinion, is considered sufficient for the purpose of updating and sharing information with others. Therefore, from the perspective of the current pattern in using mobile phone or devices, it can be inferred that the way they use their mobile phones and devices and their accessibility during their shopping trips are making it possible for them to immediately share information on prices of items.

4.2.3 Infrastructure

Infrastructure was found to be one of the influencing factors in mobile crowdsourcing participation (Aris, 2014). With regard to the infrastructure, the survey was looking into the types of their subscription to mobile plan and their experience with network connectivity disruption. The result showed that majority of the respondents are post-paid subscribers with mobile data plan (66.67%). This type of subscription means more consistent access to the internet as they will be billed monthly on their phones usage.

With regard to the network connectivity and availability, access to network is not seen as a problem or hindrance because majority of the respondents experience network disruption only occasionally, with 12.12% almost never experience network disruption

and 2.27% never experience any network disruption. This shows a good infrastructure that is currently in place, which supports the implementation of mobile crowdsourcing of information.

4.2.4 Readiness to Share Information

The last perspective that we are looking at in determining the potential of crowdsourcing in timely information sharing of prices is on the readiness of the respondents to share the information. For this perspective, we looked into their current practice in sharing prices information and photos, and their mindset about the necessity in sharing this information.

It was found that the practice of sharing of information such as photos is common amongst them. Only a very small portion of them (3.10%) had never shared photos with others. The rest did. Interestingly, 90.15% of them are currently sharing the information on prices with their friends, through various mechanisms and more encouragingly, 96.97% of the respondents are positive about sharing the information on prices. Therefore, it can be seen that they are very positive about information sharing with others and are used to it. Item price is just one of the information that they can share and based on the results obtained, there is no problem seen with regard to this.

5 CONCLUSION

This paper theoretically justified the need for using mobile crowdsourcing to obtain information on prices of items from the public to enable timely comparison on prices of items to be made. The justification was made after reviewing a selection of existing applications. An overview of the LoPrice model was also presented. On top of these, an exploratory survey was performed to determine the potential use of mobile crowdsourcing for timely information sharing of prices from the perspectives of mobile phone or device capability, usage pattern, infrastructure and readiness of the users to share information. Findings from the review and survey showed that mobile crowdsourcing is a viable approach for timely solicitation of information on prices from both the theoretical (literature) and practical (survey) points of view.

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