# Mobile Context-Aware Product Assistant

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*Abstract*—**In this paper we present an application that manufacturers and retailers can use to provide contextual product information for their customers. The application also provides a direct interactive feedback channel that the customers can use in asking questions about the products from the manufacturers and retailers. In addition to that the application also offers functionality for the customers to discuss about the products amongst themselves. The application consists of a web interface for the manufacturers and retailers and both a web interface and a mobile Java application for the customers. We conclude that this kind of an application has clear benefits for both the manufacturers and retailers as well as for the customers. The customers get guidance and assistance in using the products and the manufacturers and retailers get valuable information that they can use in their product development. We also discuss some potential difficulties that the concept might face.**

*Keywords*-**context-aware messaging; context-aware application; mobile application; product guidance; product assistance; mCRM; mobile customer relationship management**

## I. INTRODUCTION

It is all too often the case that the customer gets all sorts of guidance when buying a product, but after the purchase is made, getting help and assistance in using the product turns out to be a lot more difficult. To tackle this problem we have designed and implemented a tool that enables manufacturers and retailers to provide product information and guidance for the customers in the situation where the customers actually need it. The tool provides an interactive feedback channel that the customers can utilize in communicating with the manufacturers and retailers. This not only improves the customers' satisfaction but also generates valuable information on the problems and issues that the customers have in using the product, which can then be used in further product development.

The importance of context-aware user guidance was acknowledged already in the 1990's. One of the first applications in the area was Cyberguide which used tourists' location and time to provide them information services such as suggestions for places of interest and background information about their current location [1]. Also, many similar systems were developed for example for museum visitors and exhibition tourists [2].

In our work we have implemented an application that lets manufacturers/retailers provide contextual product information about their products to their customers. Another impor-

tant aspect is the ability for the customers to ask questions about the products directly from the manufacturers/retailers. In addition to that, the customers can also discuss about the products with other customers.

## II. RELATED WORK

Mobile customer relationship management (mCRM) has been the focus of many recent studies. In his PhD thesis [3] Jaakko Sinisalo discusses the topic thoroughly. He concludes that although mCRM has an inherent potential to benefit both company and customer, it has been utilized quite cautiously to date. Reinhold et al. [4] come to the same conclusion in their study of utilizing mobile devices in collaborative CRM processes. They state that only if the offered mobile services show benefits in the perception of customers they will make use of them and engage into collaborative processes. Some ideas for the future of mCRM are also presented by Steimer et al. [5]. They focus on the possibilities of mCRM in the automotive industry and tourism, and present different location based and personalized services that could take advantage of the enhancing mobile infrastructure. Based on the current research, one can therefore say that mCRM has lots of unutilized potential. To address this, our application aims at providing practical ideas on how mCRM could be utilized.

Other recent work has focused on recommending items based on users' context and preferences. Shin et al. [6] propose a general framework for taking into account not only user preferences, but also context information for generating recommendations. Hong et al. [7] propose an agent-based framework that utilizes users' context history for automatically predicting users' preferences and providing personalized services and products for the users. Our application is more focused on supporting the users with their current products, but can also be used in recommending new products that the users might be interested in based on the existing products that the users have.

Our work also involves utilizing context information in providing the most relevant information. In addition to raw context information such as GPS coordinates, time and accelerometer data, it is often useful to create more abstract contexts such as 'driving' or 'at work'. The raw context information is utilized in deducing the more abstract contexts

thus creating a context hierarchy. One recent suggestion for a general context hierarchy is presented by Reichle et al. [9].

Another aspect in our work is community-based product information sharing as users can discuss about the products amongst themselves. This topic has been studied before by von Reischach et al. [10] who in their paper present a concept called APriori that enables consumers to access and share product recommendations using their mobile phone. They discuss issues related to community-based product recommendations such as how willing the users are to trust other users' opinions and how motivated they are in sharing their own.

### III. The Application

In the application the manufacturers/retailers provide product information that can be assembled from different data types such as text, images, pdf and video. The product information can also be tied to a context such as location. The users can view the product information according to their preferences and/or context. They can also leave questions for the manufacturers/retailers to answer and leave comments for other users related to certain product information.

#### A. Web Interface

For manufacturers/retailers the application offers a web interface and for the customers the application offers both a web interface and a mobile Java ME application. Figure 1 shows the manufacturers/retailers' view of the web interface. The customers' web interface share a similar look and feel, but offer different functionality as manufacturers/retailers can add, modify and delete the product information, set contexts in which the product information is to be available in the mobile application and answer customers' questions while the customers can only view the product information, ask questions and discuss about the products with other customers.
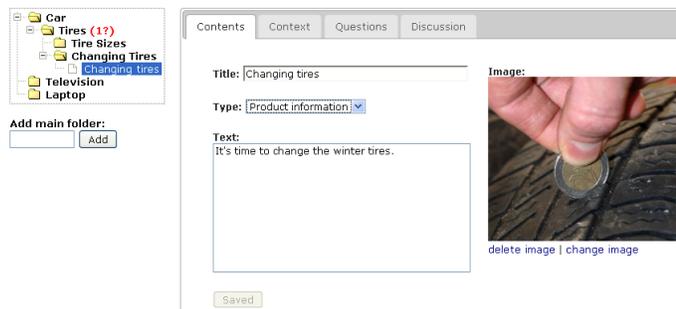


Figure 1. The manufacturers/retailers' web interface. The red numbers in brackets in the tree menu indicate that the corresponding folders / items have that many unanswered questions.

The product information items can be tied to a context so that the customer can browse only the most relevant items in the mobile application. For example, a reminder to change to winter tyres is only relevant in October, November and December when the temperature drops below five degrees Celsius. Another example would be a car repair shop providing its services in a certain location. However, it is not necessary to define a context for a product information item as in all cases the information may not be context specific.

Currently, only location names (using GeoNames[1]), maximum and minimum temperature and months can be used to define the context, but we have also defined a larger context hierarchy that we intend to support in the future. The context hierarchy is illustrated in Figure 2. It builds on lower level contexts that can be automatically recognized in the mobile device (calendar information, GPS, Cell ID, accelerometer data), and lower level contexts that can be automatically recognized in the server (time, weather). These lower level contexts are used in deducing higher level contexts (location, period of time, temperature) and user level contexts (at a hobby, at home, at work, in a car). Higher level contexts typically have distinct values while user level contexts are either active or inactive. Higher level contexts (location) as well as user level contexts can also be inputted manually by the user.
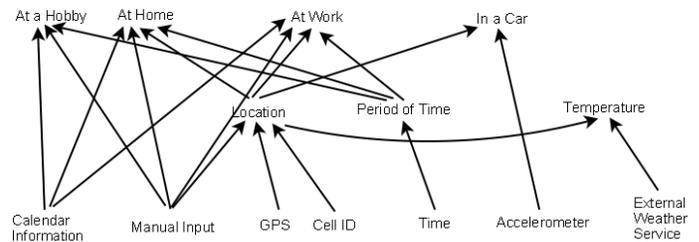


Figure 2. A suggestion of a context hierarchy for the application.

The customers can ask questions about the products from the manufacturers/retailers, and they can then answer the questions using their web interface. The customers can also discuss about the products with other customers, and the manufacturers/retailers are only allowed to view the discussion in their web interface. In the current implementation, the questions, answers and discussions can only contain text, but allowing more complex multimedia content could be useful as, e.g., the customers could take a photo of some problem in the product, which could be more informational for the manufacturers/retailers as plain text.

#### B. Customer's Mobile Application

Before the customers can start using the mobile application, they must login using their username and password.

[1]http://www.geonames.org/

After they have logged in once, the username and password are stored in the mobile device's memory and they are not required to login again unless they want to change the user. The main screen of the application offers options for browsing the product information, updating current location, changing preferences, changing user and exiting the application. The customer's mobile application is illustrated in Figure 3.
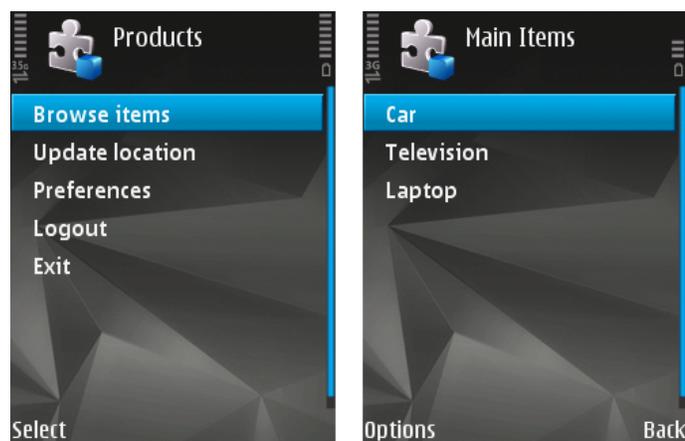


Figure 3.    Customer's mobile application.

If the customers wish to restrict the information to what is most relevant in a certain location, they must input their location. This could be achieved automatically using GPS, but currently we have only implemented a way to input the information manually. The customers can input a location name and the application searches for matching location names from GeoNames. If matching location names are found, they are shown to the customers in a list of which they can choose their current location. Previously used location names are provided in a separate list, so that customers do not need to search for locations unless they go to a new location.

## IV.  DISCUSSION

In summary, the features of the application that we have presented are:

1)  the application lets manufacturers and retailers provide contextual product information to their customers
2)  the application lets customers ask questions about the products directly from the manufacturers and retailers
3)  the application lets customers discuss about the products with other customers

The benefits of this kind of an application are clear. The customers get a direct interactive feedback channel to the manufacturers/retailers that they can use to get guidance and assistance in using the product therefore increasing customer satisfaction. On the other hand, manufacturers and retailers get to make their customers happier and at the same time get valuable information that they can use in their product development. However, there are also some possible difficulties that this kind of an application can have. These issues are discussed next.

First of all, the customers need to install and use yet another application in their mobile device. Are the customers willing to do that? To start with, the installation process should be made as easy as possible. Perhaps the application could be installed by scanning a QR (Quick Response) code with the mobile phone's camera or by touching a RFID (Radio Frequency IDentification) tag with the mobile phone when buying the product, and the application could then provide a link to the web interface also. This way the application could be used without a username/password combination. On the other hand, if every product came with its own application, the number of applications in the customer's mobile device could become so big that the customer would not bother searching for the right application for a certain product anymore and would stop using the application. Therefore, having an option to use the same application for different products should also be possible. In addition to that, it is also important to have the customer's web interface as typing large amounts of text using a mobile device is often more difficult than using a regular keyboard. However, as current mobile devices are getting better and better (keyboards, touch screens, larger displays, etc.), one possible solution could be to only have the web interface and just make a more mobile browser friendly version of it.

Privacy issues are also always relevant when talking about context-aware applications. Would the customers be willing to reveal to the manufacturers/retailers when and where they are using the products? There should always be an option to restrict the context information that is exposed.

All in all, even though a lot of information can be searched from the Internet, this kind of an application with its direct interactive feedback channel between customers and manufacturers/retailers would provide the customers with more extensive and trustworthy answers to their questions. Many applications, like YouTube, Flickr, Twitter, etc. really become interesting only after they get a substantial amount of users. However, this kind of an application would be beneficial for the users directly after its launch as interacting with the manufacturers/retailers is the application's main functionality. Only the functionality of interacting with other customers would require a larger number of users for it to really become useful. For the manufacturers/retailers it would easily be worthwile to dedicate personnel for answering the questions that the customers are making using the application as the benefits of doing so would be clear.

The main focus in the future is to make better use of context and user preferences in providing the users the most relevant information about the products. In the current implementation we have only set up some simple preferences and basic contexts. We intend to support a more extensive

set of context information and user preferences, and also to implement the automatic recognition of context for the mobile application. Also, in the current implementation the users can only discuss about the products with all other users. It would be interesting to provide a possibility to create separate user groups also. For example, users who share the same hobby could discuss about products related to the hobby amongst themselves. In the future we also intend to verify the concept by running some experiments with actual users.

## V. CONCLUSION

In this paper we presented an application that manufacturers and retailers can use to provide contextual product information for their customers. While the application is still in its preliminary stages, we focused on discussing the possibilities and challenges of the concept behind it. The main benefit that we discussed was that this kind of an application would provide guidance and assistance to the customers and a direct feedback channel to the manufacturers and retailers. Some of the potential difficulties that we highlighted were privacy issues (what kind of context information the customers would be willing to reveal) and whether the application should be a stand-alone mobile application or a web application. In the future we intend to develop the prototype further and explore these issues with actual users.

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