Modularization of Mobile Shopping Assistance Systems

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Abstract - Due to the high cost of time, several methods are proposed to reduce the wastage of time in a shopping procedure. So, we proposed a Modularized Mobile Shopping System Assistance System which will be supported by various mobile technologies such as wireless network, GPS, NFC etc. and a secured encryption for providing safe and secure transaction to ease the shopping process.

Keywords - **NFC, Shopping assistance system, Mobile shopping, Modular shopping, secure payment, Mobile shopping Assistance.**

1. Introduction

A customer shopping process consists of several essential and optional tasks like payment or information retrieval. This paper presents an overview of the possible solutions in the field of Mobile Interaction that can be applied in order to perform these tasks in future applications based on current and upcoming communication and interaction technologies. The tasks are represented by several modules, like shopping list management, orientation, shopping basket management, coupons redemption and payment. These modules conceptually describe the available opportunities to realize specific parts of a customer shopping process based on several technologies and customer behavior. In particular, a deep insight into solutions based on Near Field Communication (NFC) is provided. For the first time, the modularization of shopping assistance systems has been considered.

It is a substantial advantage for the retailer as it enables the analysis of the benefits and drawbacks of technologies and services. Furthermore, it allows the investigation independent from basic technologies like RFID and barcodes. Regardless of the used technology, the modules can be linked with each other which allow a simple integration of several modules in a retailer's infrastructure. Depending on the usage context, several combinations of modules are more applicable than others
Modules:

1. Shopping list management
2. Orientation
3. Product information
4. Shopping basket management
5. Coupon redemption
6. Customer loyalty reward
7. Payment

2. Implementation Aspects of Proposed Model

A) Mobile based Shopping Assistance System

This system summarizes the work on design and implementation of Mobile based Modularized Shopping Assistance System. The system consists of three main modules:
1. Adding product to shopping list.
2. Finding the products in the store
3. Coupons redemption and final payment.

B) Is The Procedure Feasible and Secure?

As far as feasibility is concerned, it is of two types:
1. Operation feasibility,
2. Technical feasibility.

Operational feasibility will include the algorithms which are being used in the system development. These are: A* Algorithm, XOR Encryption-Decryption Algorithm for security purpose.

Technical feasibility refers to the technologies used to carry the system workflow.

Table 1: Technical feasibility

Programming Language	JavaScript, PHP
Hardware	NFC smartphone
Front End Programming	JAVA
Technology	NFC, Wireless Network

3. Proposed Workflow

The proposed architecture helps in understanding Modularized Mobile Shopping Assistance System. The components of the following workflow are: Registration flow, Product Management flow, Purchase Process flow, Database flow. The descriptions of the above named components are as follows:

3.1 Registration Flow

To shop at market, customer has to make a user account. All the information about user will be stored at database.

3.2 Product Management Flow

Seller has to put all the data of available products including id for each product that is matched with the barcode of that product. Products can be equipped with NFC tags for more ease.

3.3 Purchase Process Flow

a) Customer has to make a shopping list either using any of the available mobile technology; his shopping list will be stored in his local and web databases.
b) Customers will be suggested new items based on his previous purchases and from other customers who had purchased similar items as his.
c) Customer will be guided to the product with the help of shopping store's map and user's current position (using algorithm 1).
d) Customer pays for purchased item's based on his shopping list using NFC service. The data is secured with XOR encryption algorithm (using algorithm 2).
e) The purchased items will be stored in user account and those products will also be removed from seller product database.
f) After purchase, NFC tags will be removed from the product.

4. Algorithms

4.1 A* Algorithm

A* algorithm is an informed search algorithm which uses the heuristic function to find out the next possible and feasible node which should be considered in the tree traversal. We are using this algorithm to navigate user to the products in the shopping mall.

function A*(start,goal)
closedset := the empty set   // The set of nodes already evaluated.
openset := {start}   // The set of tentative nodes to be evaluated, initially containing the start node
came_from := the empty map   // The map of navigated nodes.

g_score[start] := 0   // Cost from start along best known path.
// Estimated total cost from start to goal through y.
f_score[start] := g_score[start] + heuristic_cost_estimate(start, goal)

while openset is not empty
current := the node in openset having the lowest f_score[ ] value
if current = goal
return reconstruct_path(came_from, goal)

remove current from openset
add current to closedset
for each neighbor in neighbor_nodes(current)
if neighbor in closedset
continue
tentative_g_score := g_score[current] + dist_between(current,neighbor)

if neighbor not in openset or tentative_g_score < g_score[neighbor]
came_from[neighbor] := current
g_score[neighbor] := tentative_g_score
f_score[neighbor] := g_score[neighbor] + heuristic_cost_estimate(neighbor, goal)
if neighbor not in openset
add neighbor to openset

return failure

function reconst
ruct_path(came_from, current_node)
if current_node in came_from

p:=reconstruct_path(came_from,
came_from[current_node])
return (p + current_node)
else
return current_node

Cost of searching: = |h(n) – h*(n)| <= O(log h*(n))
Where h*(n) = true cost of getting from n to the goal.

4.2 XOR Encryption Decryption Algorithm:

Encryption and decryption algorithms are processes of converting plain text and numbers in their cipher text form, it is generally done to provide security to whatever data we want to make confidential.

Encryption Algorithm:
1. k = key for encryption.
2. t = text to encrypt.
3. res = {empty}
4. Loop (length of t)
4.1 cc = character code of current char of t.
4.2 res = res + to character from code (k XOR cc).
5. End

Decryption Algorithm:
1. k = key for encryption.
2. t = text to decrypt.
3. res = {empty}
4. Loop (length of t)
4.1 cc = character code of current char of t.
4.2 res = res + to character from code (k XOR cc).
5. End

Time complexity = O(n).
Where n is the length of input string.
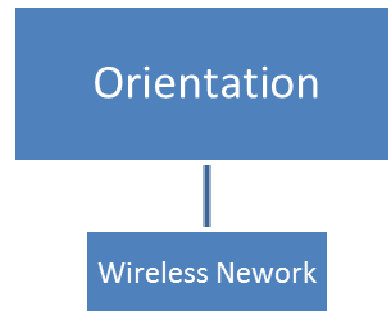
5. Figures

5.1 Shopping Process Overview
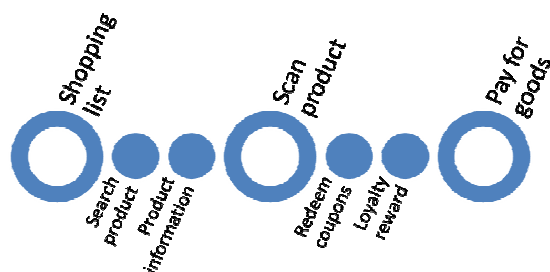
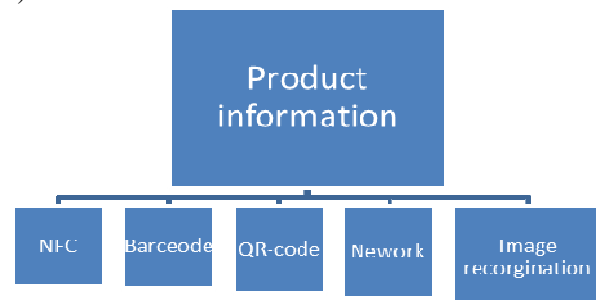5.2 Shopping Process Modules and Feasible Technologies

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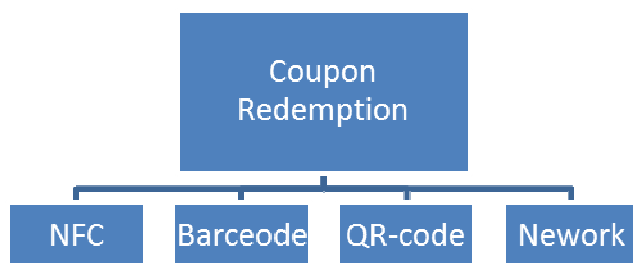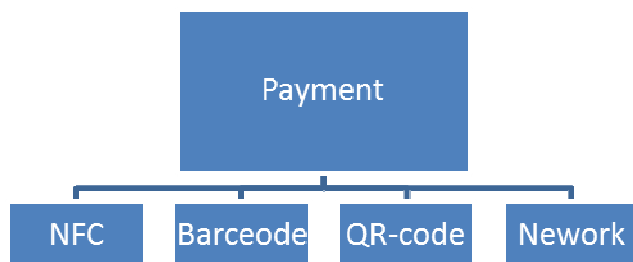ISSN : 2348 - 6090
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6. Conclusions

In this system, the customer shopping tasks which have been mapped to modules. These modules include shopping list management, orientation, product information procurement, shopping basket management, coupon redemption, customer loyalty reward and payment. Each module is implemented using a set of different mobile technologies and requires certain customer behavior. As the modules are independent of each other, it is possible for the retailer to implement a solution that fits the market's needs. For example, it can combine scanning of barcodes on products for the shopping basket management and NFC technology for the payment process. The overview of the modules including the available technologies aims at helping retailers to identify possible benefits or drawbacks of technologies or services for their stores. After deciding which modules they want to implement in their markets and which technologies they want to use, the retailers can easily integrate them into their infrastructure.

Even if the available technologies change in the future, e.g. through the integration of sensors into the shopping environment, which can e.g. identify the customer and his behavior, the seven modules will retain, just the technologies and the customer's behavior will change. It is planned to implement all described modules including all mentioned technologies and use cases. Having this shopping framework, several studies will be conducted which shall identify which technologies and use cases customers prefer for each shopping task.

References

[1]   Modularization of mobile shopping assistance systems by Paradowski, Denise; German Research Center for Artificial Intelligence Campus D3_2, 66123 Saarbrücken, Germany ; Kruger, Antonio.
[2]   An NFC-Based Solution for Discount and Loyalty Mobile Coupons by Sanchez-Silos, J.J.; Dept. of Computer. & Numerical Anal., Univ. of Cordoba, Cordoba, Spain
[3]   Mobile Near Field Communications (NFC) "Tap 'n Go" Keep it Secure & Private By Ann Cavoukian, Ph.D. Information and Privacy Commissioner, Ontario, Canada
[4]   http://en.wikipedia.org/wiki/A*_search_algorithm
[5]   http://en.wikipedia.org/wiki/XOR_cipher
[6]   Importance Measures for a Modular Software System by Fiondella, L. ; Dept. of Comput. Sci. & Eng., Connecticut Univ., Storrs, CT ; Gokhale ,S.S.

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