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Design and architecture of retailapp: an application to support conventional retailers

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Abstract. Over the last few years, the preference on shopping over internet application, usually called online shopping or e-shopping, has increased significantly. One of the major advantage of online shopping is the capability to use digital content to support the marketing process. Prospective buyers can conveniently browse and look to a certain object and find the information needed with a few clicks. Moreover, the use of multimedia (such as images, sound, and movies) may help prospective buyers to make a decision faster than conventional shopping at retailers. However, shoppers still consider that conventional shopping is the best way to perform shopping due to the ability to make a physical contact to the object. Our objective is to merge these experiences by enabling user to find digital content that relate to nearby retailers. In this research, we built a mobile application that collects data from nearby retailers and shows it to its user. By using this application, it will be easier to users to find the location of the object and to find nearby promotion.

1. Introduction

1.1. Background
In the past few years, there are tendencies that users prefer to perform shopping via online shop than conventional retailer and store. There are many factors that may trigger this tendency such as easier and lesser effort to perform the shopping and the capability to find more information regarding the desired product. User can easily search the desired product simply by using the search feature which is an obligatory feature in online shops. Moreover, user can easily find useful information regarding the product such as detailed specifications, reviews, and recommendations. Both of these features are unavailable in conventional shopping; all information regarding the product came from the seller who tend to give positive information to prospective buyer.

However, the inability to directly access the product can sometimes repel customer to perform online shopping. Some products, such as wearable items, may require direct contact to measure its quality. Moreover, easily expired product such as foods and drinks might never have a chance to be sold online. Hence, the role of conventional shopping still has an advantage against modern online shopping. To keep itself relevant, conventional store have to maximize these advantages and give a different shopping experience compared to online shopping to be able to attract modern shoppers. One of the many solutions available is to use computer and information technology to assist stores and retailers in creating a distinct experience.
In this paper, we present the design and architecture of RetailApp, an application that may help conventional store and retailer to add online shopping features to its shopping experience. The objective of this paper is to discuss the design of the proposed system and to analyze possible technologies that may be used to build the application in the future. While we understand that retailers contain massive and lengthy processes, our current system only covers marketing and customer experience. The paper will be structured as follows: the next section will present works from other researches that related to our system. Later, we will define the requirement of the system by analyzing the current state of conventional store and retailer. Based on these requirements, we will design the architecture of the system and explore possible technologies compatible to the proposed design. The last section will discuss the conclusion and future works of our research.

1.2. Related Works
One of the major audit service provider in the world, KPMG, publish an article that discuss the global trends in retail industry. Among the top 5 trends listed in the article, the first two is directly related to the use of technology; the use of technology to increase the quality of customer experience (such as virtual reality and augmented reality) and the growth of mobile shopping [1]. The other 3, while not directly related to computer technology, also suggests the use of computer to create an advantage over competitors. Needless to say, the article suggest that the use of computer based system is vital in order to attract technology-aware customer. A similar suggestion is presented by Price Waterhouse Cooper, another major auditor service provider. It released a list of investment retailers can make to increase the competitiveness of its company [2]. Four of the 10 items in the list are related to computer based solution; mobile site, big data, secure platform, and amazon-based strategy. These two articles show the importance of conventional retailers and store to adopt information technology to survive the modern competition.

In accordance with the need of modern computer-based solutions to aid conventional retailers, some researches have proposed solutions related to this need. Adhikari et al. developed IntelligShop [3], an implementation of location based augmented reality that helps user to find information regarding a certain store. User can simply capture the front of a store using his/her smartphone camera and the application will search and show reviews related to the store. Rienzo et al. presents smart retailer environment [4], a concept that uses screens and RFID to increase the efficiency of marketing inside a conventional retailer shop. The system detects nearby prospective customer by using wireless technology such as bluetooth and warns nearby system to display a certain content based on user’s profile. Mahoney et al. analyze the relation of retails location and the structure of the consumer community [5]. Early investigation shows that each community has their own characterization and it requires different approach and it is possible to gather this information using the data in social media. Meneweger et al. propose a solution to use mobile computer technology as sales assistants [6] to aid conventional human-based sales assistant in providing customer profile and products marketing. Karamshuk et al. developed Geo-Spotting, an application that may help in deciding store placement based on location-based data [7]. By using the data of customer attendance and purchase history, the system able to predict the optimal location of a store.
Some technologies proposed to help conventional retailers depend heavily on customer location. These researches suggest that the most prospective buyer is the one located nearby the store. Hence, it is important for conventional store to gather nearby user's profile and promote based on that information. In 2014, Apple proposed iBeacon [8], a system that detects nearby user by using Bluetooth Low Energy [9]. The system is directed to conventional store to create an on-the-go marketing technique to attract a certain customer. Moreover, the system allows store to send a notification to nearby prospective customers which gives a new method to perform a marketing.

2. System Requirements
Based on the previous background observation, we developed a list of requirements that can be used as a reference to build the architecture. This section will list the requirements of our future system capability.

2.1. Customer Localization
The system depends heavily on customer localization. The localization is categorized into two process; macro-localization and micro-localization. The macro-localization is used to detect user's location based on its smartphone localization system (which mostly depends on information gathered from GPS and Wi-Fi Routers). By using this macro-localization, the server will gather information from nearby stores and send the information to the user.

The second localization is micro-localization, which is used to predict the exact location of the user. By using the exact location, the system gathers the user profile, characteristic, and behavior to be used by the store to create a more personalized marketing technique. Moreover, this information may assist store assistant to give a better service to the customers by giving a detailed and thorough information regarding a specific product. Store assistant ability to predict the user's preference may increase their efficiency by focusing on a certain case or knowledge that important to the user. For example, a user that visited a sport apparel store tend to have an interest in sport product. This information is important to other sport apparel stores since there is one or more prospective customer nearby.

2.2. Intelligent Shopping Assistant
Another feature we would like to add to the system is AI powered shopping assistant. The purpose of this feature is to assist users to perform shopping such as suggesting similar product, gathering reviews, and planning shopping route. The use of artificial intelligence as shopping assistant is common in modern online shopping. Users often suggested products based on their recently viewed product or visited website. We would like to add similar experience to the proposed system. The system should be able to predict products suitable to customer based on three information:
1. Purchased product
The information of recently purchased product is vital to predict the prospective product. Users tend to buy multiple similar products. Moreover, users tend to buy other product that may complement to the previous products. Users that purchased a computer tend to buy additional accessories such as display, mouse, and keyboard.

2. Visited store
Visited store can give a slight information regarding user’s purpose or interest. We argue that a user visiting a store without purchasing a product is currently looking for a better option of the product sold on the store. The system may help the user by providing similar products to the users.

3. Shopping behavior
Users tend to have a repeat pattern of shopping. By using this information, the system must be able to predict the user’s shopping list before they even perform the shopping. This information is also given to stores and retailers so that they may predict customer’s behavior and create a more efficient strategy to attract prospective customers.

2.3. Shopping Privacy
While the system provides information regarding customers shopping behavior, the system must be able to keep the privacy of users. Some users prefer to keep their anonymity during the shopping process, yet others prefer a more personalize and efficient shopping experience. The system must allow the users to retrieve information from nearby stores without sending any information regarding to the users to the store. This security feature is important to keep the control of information in the hand of the customer.

3. Application Architecture
Our system is based on client-server architecture with both customer application and store application both act as clients. All data regarding customer information and store notification is stored in an online database server. To keep the communication protocol as simple as possible, we build the use HTTP for communication between the client and the server. Figure 2 below is the architecture of our system.

![Data Flow Diagram](image_url)

**Figure 2.** Data Flow Diagram for Macro-localization (top) and Micro-localization (bottom)
The system contains two sub-systems: the macro-localization which responsible in giving overall statistics of nearby customers to the store and nearby store information and promotion to the customer. The overall statistics contains a rough information regarding users demographic nearby the stores such as the amount of nearby customer and rough information regarding customer’s average behavior. The micro-localization is responsible a detailed information regarding a customer to the store. The system detects nearby customer by using a short-ranged wireless system such as iBeacon or Bluetooth Low Energy technology and gather the customer’s information from the server. This information is presented to the store owner, manager, or assistant so they can provide a personalized service to the customer.

4. Conclusion and Future Works
This paper presents the design and architecture of RetailersApp. Its objective is to assist conventional store to give a unique shopping experience in order to compete against online shop. We present the requirement and the thorough architecture of the system that can be used in future development process. The next step of this research is to build and implement the system in real life situation.

However, there are many things needed to be considered in the future regarding the feature of the system. We have yet not discussed the security aspect of the system which is important considering the system holds a detailed customer's shopping history and behavior. We also haven’t designed the implementation of the system, which requires intense coordination with retailers and stores.

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References
[1] KMPG 2017 Global Retail Trends
   https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2017/06/retail-trends.pdf
[2] PWC 2017 10 Retailer Investments for an Uncertain Future
   www.pwc.nl/en/publicaties/total-retail-2017.html
[3] Adhikari A, Zheng W V, Lin M, Fang Y, Cao H and Chang C K 2015 IntelliShop: Enabling Intelligent Shopping in Malls through Location-based Augmented Reality Proc. Int. Conf. on Data Mining (Atlantic City, NJ: USA) p 1604
[4] Rienzo D A, Fra C, Garzotto F, Valla M and Cremonesi P 2015 Towards a smart retail environment Proc. Int. Joint Conf. on Pervasive and Ubiquitous Computing and Proc. Int. Symp. on Wearable Computers (Osaka: Japan) p 779
[5] Mahoney J, Lawson S and Stone R 2014 “What do you think of the return of dungarees?”: Social Media Interactions between Retail Locations and their Customers Proc. Int. Conf. on Human Factors in Computing Systems (Toronto, Ontario: Canada) p 1927
[6] Meneweger T, Zachhuber D, Wiflinger D, Tscheligi M and Asian I 2013 Towards the Counter Free Store: Requirements for Mobile Sales Assistants ACM Conf. on Pervasive and Ubiquitous Computing Adjunct Publication (Zurich: Switzerland) p 999
[7] Karamshuk D, Noulas A, Scellato S, Nicosia V and Mascolo C 2013 Geo-Spotting: Mining Online Location-based Services for Optimal Retail Store Placement KDD’13 (Chicago, Illionis: USA) p 793
[8] Chen BW and Ji W 2016 Intelligent Marketing in Smart Cities Crowdsourced Data for Geo-Conquesting IT Professional 18 p 18
[9] Aman S M, Jiang H, Quint C, Yelamarthi K and Abdelgawad A 2016 Reliability Evaluation of iBeacon for Micro-Localization Ubiquitous Computing, Electronics & Mobile Communication Conf. (New York: USA)