Shoppal – Best Offers at Your Fingertips

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Abstract- Technology expansion has numerously contributed to marketing. The researchers built "ShopPal" to provide hassle-free shopping experiences to users. This is a mobile application displaying advertisements of individual shopping areas, not shopping malls. It also consists of billboards in shops that would display promotions in the shopping place based on age category of majority present in the area at a given time. A stored procedure was used to find preferences of given age categories. It is used to provide suggestions when consumers select product choices, when registering. Customized offers based on location, tracked using Global Positioning System (GPS), are sent to users. Customer connects to billboard via Bluetooth. Clustering is used to identify age category of majority of gathered customers and promotions are displayed accordingly. The system would be greatly beneficial to consumers and shop owners. "ShopPal" is an ideal location-based offer advertising system that gives consumers a hassle-free shopping experience.

Index Terms- Offer Advertising, K-means Clustering, Stored Procedure, GPS

I. INTRODUCTION

Advertising has reached new heights at present and has even reached a point where offers and promotions are advertised not only based on the user preferences and interests but also on location. With this new trend, it is of importance to have a system that would not only support mobiles but also one that would give an alternate option of viewing the offer or promotion for the targeted audience. A variety of offer targeting systems, location based services, data mining applications and intelligent digital signage systems have been developed so far.

In this research, a location-based offer advertising system was developed with the use of a smart billboard for the same. "ShopPal" is a targeted advertising system that contains both a web and mobile application. A smart billboard is introduced along with the mobile application. This billboard is synced with the mobile application through Bluetooth and buying preferences of the majority of users will be taken into consideration when displaying the content on the public display. It will contain content related to the majority of the crowd at a given time.
The technologies used in the system will be Global Positioning System (GPS) and Bluetooth. GPS is used to track the current location of the system and the latter is used to sync the billboard with the mobile application.
Shop owners registered with the system can use the web application to upload offers given by them and these will be checked and sent to mobile users by those handling the website. The shop owners also have the facility to view offer details of

similar offers in the area. Mobile users can download the application and when registering with the system they will be given the chance to select categories they are interested in. This is suggested to the users using results obtained through data mining. These will be taken into consideration when displaying offers. The user route is tracked and if there are any shops with offers desired by the particular customer, it is indicated on the map. The offer notification will be purely based on the areas the application user is interested in. A billboard is used to display offers based on the age category of the majority. The majority is identified using clustering. This billboard will be synced with the mobile application through Bluetooth.

The objectives of building "ShopPal" include; a) to analyse the buying patterns of customers based on their age categories, b) To display the offer notification on mobile based on their preferences and location and c) To display offer notifications on a billboard based on the age categories of the majority of the mobile application users in the location.

The rest of the paper is organized as follows. Background covers the existing literature on this topic. Methodology section covers the method we used to develop the system. Results and Discussion includes the results of our system and finally conclusion includes limitations and future work.

II. BACKGROUND AND RELATED WORK

A. BACKGROUND

Considerable effort has been put into identifying the location of an individual. Mobile marketing on the other hand is still a new approach in the world of business. Offer advertising has turned over a new leaf with the development of technology and little previous work has been done towards identifying customer buying patterns and sending customized offer advertisements to consumers via mobile and also displaying offer advertisements on public digital displays. This section explains previous work done on offer advertising systems, location based services, data mining applications and those involved with digital displays.

B. RELATED WORK

B.A. Offer Advertising

Kraft in [9] creates and presents the details found on individual user profiles used in collaboration with the physical geographic location of a consumer. The invention solves the problem of advertising tailored so that it is suitable to both the user and their current location by including a customer's profile and their current location into the advertising message. Also, the invention consists of location tracking along with a personal electronic calendaring system. Further, this message is made more

personalized with the use of a relative address/direction that start from the current customer's location. This could be in terms of driving directions, using the current physical position of the user as a start address. The location tracking component locates the current location of the customer. This location information is used to advertise products or services which are in close proximity to the customer's current location.

Wanek, Ayub and Boyd in [17] has reviewed on methods and systems target advertisements using real-time information such as location-based, defined geolocation territory rights and weather-related information. The invention relates to those methods and systems improved to display advertisements or other promotional information to users via mobile devices. The paper includes a method for delivering a message to a mobile device that comprises of selecting one or more messages targeted based on location-based, advertiser GeoEstate rights and weather-related information relating to said mobile device's location.

Chen and Huang in [5] investigates a smart environment, "Intelligent Shopping-aid Sensing System (iS3)", for online shopping support in the years to come by developing a context-aware automated service system. Sensors and radio frequency identification (RFID), are applied for recognizing, collecting, and delivering user context. Product details like locations, specifications, and characteristics can be gathered swiftly through the deployed RFID reader and display. Moreover, local mobile devices applications help real-time interactions between central system and end users. Prompting product promotions, inquiry and online marketing to shopping malls is expected to be done by the system. According to experimental results, the quality of recommendations with the proposed approach reaches 70 % accuracy rate and traditional and non-clustering approaches are 56% and 46 %, respectively [5]. This study decreases the long-term retailer operation costs, stimulates service innovation and experience economy and enhances corporate operational performance.

Faith in [7] shows a review which provides a computer-implemented process for determining offers for a geofenced geographic area. Once a mobile user crosses a geofence, merchants having a geofence identifier and is associated with the particular geofence are identified. Candidate offers associated with the merchants are identified and these identified offers are ranked according to ranking criteria and they are then transmitted to a mobile device. The ranked candidate offers are then stored on a mobile user device and presented to the user via an offers notification. The user may view and redeem an offer by selecting the notification. Additionally, in some representations, a non-temporary tangible computer-readable memory is given to store instructions for determining relevant offers for a geofenced geographic area. Further, in some others, a computer-implemented method is given for determining relevant offers for a geofenced geographic area. The method includes getting, via a processor, a detected crossing of a geofence, the geofence defining a perimeter around a geographic area that includes one or more retail stores related to one or more merchants and transmitting, via a network and from a mobile.

B.B. *Digital Signage Systems*

Payne and David in [13] proposed BluScreen, an approach to advertise in public spaces that uses wireless-enabled devices to improve the public display advertisement selection. A multiagent system is used here to determine appropriate content. Interactions with BluScreen are passive and not initiated by the user. "BluScreen is a distributed advertising framework in which advertisements are selected efficiently to maximize their exposure to as wide an audience as possible." [13]

Cardoso and José in [4] penned a research on a context-aware display. A context-aware display should deliver the right information at the right time. It was started by analyzing interaction alternatives form the perspective of the information they generate. The concept of digital footprint was used to refer to the digital traces generated by the interactions with the display. Presence identification is done with the use of a personal device with Bluetooth. Self-exposure footprint will get interests, preferences or activities of the people nearby. Another way would be to register the user so that their preferences can be taken. The use of Bluetooth allows the user to manage his presence himself. However, Bluetooth naming is less suited when it comes to private naming as it is visible to anyone and everyone.

Digital signage industry is now only second to the internet in terms of annual advertising revenue growth [15]. Tian et. al [15] proposed an Intelligent Advertising Framework. It introduces the integration of Anonymous Video Analytics (AVA) and Data Mining techniques to achieve targeted and interactive advertising. This reduces waste by advertising to potential customers rather than to the entire population. AVA is used to capture human faces and capture demographic information, and data mining algorithms are used to learn advertising models. AVA includes three steps; human face detection, demographics recognition and viewing event creation. Data mining is used to discover patterns of viewing behaviours of the audience. Audience targeting methods are of three types; seeing-based, to target once the display sees them, prediction-based, to predict future passes and context-based, to target depending on the device location, time and weather information. The targeted advertising process is also divided into learning advertising models, creating playlists and playing playlists. The advantage of the framework proposed is that the AVA component is privacy friendly.

Intelligent digital signage systems can adapt the displayed contents to the audience in real-time. Batagelj, Ravnik and Solina in [1] showed how digital signage is made much more effective by using computer vision technology. By using a video sensor, the system could be made intelligent. Intelligent systems can display targeted ads to customers actually present at a moment. It can give the right message to the right audience at the right time. The system consists of two parts; the detector that captures the frame and calculates how long a face is present in front of the camera and a web application that generates reports.

B.C. *Location – Based Systems*

Singhal and Shukla in [14] penned on the implementation of location based services using GPS and web services in Android.

Location based services offer personalized services to mobile clients based on their current location. These services include consumer services including maps navigation, marketing/advertising, location based reminders and preferred location search [11,14]. The device location can be tracked by either a mobile phone service provider network or satellites. A mobile phone with GPS is integrated by Assisted-GPS which is the new technology used by smart phones. It reduces the memory and hardware required by mobiles to provide GPS services. The advantage of the former is that it does not carry additional costs. Application Programming Interface (API) is also given by Android to access Google Maps which facilitates the user to find required places on the map. However, the implementation of Location Based Services has its drawbacks in the areas of technology and infrastructure.

A similar research has been done by Rani et. al [11] on location based services in Android. "Location based services is an umbrella term used to describe the different technologies used to find the current location of a device" [11]. Location Manager and Location Provider are the two main elements of Location Based Services (LBS). Location Manager finds the current location, does movement tracking, used to set proximity alerts for locations that are specified and also to find all available location providers. A variety of applications can be developed in Android one such being finding the route between two locations. The application developed here is able to find the route between two locations. LBS are services that can be accessed using mobile devices via the mobile network. Context awareness is a feature of LBS. LBS uses technologies such as GPS, satellite network, cellular networks, Wi-Fi and other technologies to find the location of a mobile device. Varying accuracy, user movement and multitude of location sources can be stated as reasons for inaccuracy of location-tracking.

Bhatia and Hilal in [3] reviewed on a new approach for location based tracking. Here, a "Localize Intelligence Algorithm" is developed in the field of tracking location. Location Based Services are used in areas such as navigation, for sending advertisement and marketing information and for location tracking. Location tracking works with networks such as Global System Mobile Communication (GSM), General Packet Radio Service (GPRS) and Code Division Multiple Access (CDMA). The "Localize Intelligence Algorithm" is used to micro define an area and name based on the latitude and longitude differences. It increases the accuracy of position of the user. Here, the client receives signals and the coordinates from the satellites. A localized location engine is designed here. The results include the latitude and longitude coordinates for a prespecified user location and also shows all locations along with their names on a map.

Babu et. al [2] penned a review on an intelligent android mobile based real time ads tracking system. The expansion of wireless technologies has given the domain of mobile marketing a new platform. The paper introduces iMAS and location-based marketing. Location-based advertising helps improve sales and brand-awareness among the potential customers. iMAS uses location based services and Global Navigational Satellite Systems the ad poster store and navigate using the route that is displayed between their current location and the store. The GPRS facility of android mobile is used to connect to the remote iMAS server. "The iMAS system, implemented using intelligent decision-and context-centric middleware, provides an effective basis upon which personalization in service provision can be achieved in a commercial location-based marketing system." [2]

B.D.   Data Mining Applications

Ling and Li in [10] discussed Data Mining for Direct Marketing: Problems and Solutions. "Direct marketing is a process of identifying likely buyers of certain products and promoting the products accordingly" [10]. In direct marketing, knowledge is a description of probable buyers or responders, and this is useful in getting a better profit than mass marketing. The most obvious problem stated in the framework is the extremely imbalanced class distribution. Typically, only 1% of the examples are positive (responders or buyers), and the rest are negative [10]. The second problem is that even if there are sensible patterns to be found, the anticipated accuracy cannot be used as a suitable evaluation criterion for the data mining process.

Rygielski, Wang and Yen in [12] discussed a framework on Data mining techniques for customer relationship management. Data warehousing, data mining, and campaign management software techniques have made customer relationship management a new area where a firm can obtain a competitive edge over others. May different techniques exist among data mining software, and each of them have their own advantages and challenges for different types of applications. They discuss that Data mining techniques are the result of a long research and product development process. The root of data mining lies with first the storage of data on computers, and continues with improvements in data access. Today technology allows users to navigate through data in real time. Towards the end, it is mentioned that to choose a suitable technology for personalization or CRM, organizations should be aware of the trade-offs when considering differing data mining software applications. To make a choice among different options is not as critical as making a choice to use data mining technologies in a CRM initiative. "Data mining represents the link from the data stored over many years through various interactions with customers in diverse situations, and the knowledge necessary to be successful in relationship marketing concepts" [12]. Technologies vary in terms of effectiveness and ease of use. It is businesses and managers who decide how to exploit collected data. Basically, it is more of a policy issue than a technology issue.

Vinodhini and Chandrasekaran in [16] have come up with a framework which discusses Sentiment Analysis and Opinion Mining. "Sentiment analysis is a natural language processing type for tracking moods of the public regarding a particular product or topic" [16]. It involves in building a system to study opinions about the products made in blog posts, comments, reviews or tweets. Sentiment analysis can be useful in several ways and along with that have several challenges too. The first is that the opinion could be either positive or negative. A second challenge would be that people do not always express opinions in similar ways. There are some main fields of research noticeable in Sentiment analysis: sentiment classification, feature based Sentiment classification and opinion summarization. The soaring of sentiment analysis dates back to late 1990"s, but it becomes a major emerging sub field of information management discipline

only from 2000, especially from 2004 onwards [16]. It was stated at the end that from the performance achieved by these methods it is difficult to judge the best choice of classification method. The reason for this was that the method uses a variety of resources for training and different collections of documents for testing, various feature selection methods and different text granularity.

Chen et. al [6] penned a framework on the literature review of Data mining for the Internet of Things (IoT). In this paper, a systematic way to review data mining in knowledge view, technique view, and application view is given, including classifying, clustering, association analysis, time series analysis and outlier analysis. The latest application cases are also surveyed. More the devices connected to IoT, large volume of data should be analyzed and the latest algorithms should be modified to apply to big data. Data mining involves discovering novel, interesting, and potentially useful patterns from large data sets and applying algorithms to the extraction of hidden information. Many other terms are used for data mining such as knowledge discovery (mining) in databases (KDD), knowledge extraction, data/pattern analysis, data archeology, data dredging, and information harvesting. Any data mining process objective is to build an efficient predictive or descriptive model of a large amount of data that best fits or explains it and is also able to generalize to new data. On the basis of the definition of data mining and the definition of data mining functions, a typical data mining process includes the three steps; Data preparation: prepare the data for mining, Data mining: apply algorithms to the data to find the patterns and evaluate patterns of discovered knowledge and Data presentation: visualize the data and represent mined knowledge to the user. According to their framework, data mining functionalities include classification, clustering, association analysis, time series analysis, and outlier analysis. They also discuss new big data characteristics and analyze the challenges in data extracting, data mining algorithms, and data mining system area.

Koh and Tan in [8] have come up with a review which explains Data Mining Applications in Healthcare. In healthcare, data mining is becoming increasingly popular, if not increasingly essential. Data mining applications can aid all parties involved in the healthcare industry. The large amounts of data generated by healthcare transactions are too complex to be processed and analyzed by traditional methods. Data mining gives the methodology and technology to transform these data into useful information for decision making. It discusses data mining and its applications within healthcare in major areas such as the evaluation of treatment effectiveness, management of healthcare, customer relationship management, and the detection of fraud and abuse also giving an example of a healthcare data mining application involving the identification of risk factors associated with the onset of diabetes. Under health care data mining applications, it was stated that these applications can be grouped as the evaluation of treatment effectiveness; management of healthcare; customer relationship management; and detection of fraud and abuse. Healthcare data mining can be limited by the accessibility of data, due to raw inputs for data mining existing in different settings and systems, such as administration, clinics, laboratories and more

B.E. Research Gap

In this section, the research group review some recently developed Offer Advertising systems along with location tracking [7,10,13] and also intelligent billboard systems [7,13,14]. Most of the Mobile Advertising systems contain GPS technology as it is easy to implement and some of the system have used iBeacon technology. Most of the billboard systems contain Bluetooth. Almost every research only covers the Mobile Advertising; not Mobile Advertising along with billboard systems. Some of the researches are not managing the customer relationship properly because they use Sentiment Analysis methods for data mining; therefore, gathering information on public mood may be somewhat inaccurate [16]. Hence the research project team will build a mobile app to display offer advertisements by gathering buying patterns of the user and display by tracking the location by using GPS along with the billboard system which will sync via Bluetooth.

In billboard system, the system will navigate the crowd and their buying patterns to display the offers and it will be added to the customer's shopping experience. As the research's main objective is the customer relationship management, to add that, the research team has come up with this Smart Billboard System due to some reasons; the user may not be able to use the mobile phone every time due to lack of signal, user may be driving the vehicle or absence of mobile data. Therefore, "ShopPal" will give the solution by coming up with the Smart billboard system.

It could be stated by looking at all this that this research can identify as an all in one system, with the advantages of high efficiency and easiness because the team introduces mobile advertising with location tracking along with the smart billboard system. High accuracy can be achieved because to identify the buying patterns the team will be using Market Basket Algorithm, GPS for location-tracking and Bluetooth for syncing the mobile with the billboard. Also with the advantage of high portability the system is a mobile application, low cost for installation and for devices.

III. METHODOLOGY

The prototype methodology was used to achieve the project goals. Analysis, Designing and Implementation phases were executed concurrently and iterated until the project reached all the objectives. First prototype was built with the minimal number of features and the other features were added to each prototype produced. This chapter briefly discusses each and every software development phase followed by the group in developing ShopPal.

A. Planning

According to the identified requirements the gathering of information had to be carried out. Primary data sources of the system were obtained through a questionnaire whereas secondary data sources were obtained from research journals and articles.

Based on statistical analysis results, it could be stated that majority prefers an Android mobile application along with the billboard as an alternative to the mobile application. It also could be stated that buying preferences, technological factors like the mobile and billboard and age are factors affecting the user's shopping experience.

B.   Design

The logical diagrams were converted to physical diagrams during this phase. Development strategies and the methods of implementing the decided strategy was discussed during this phase.
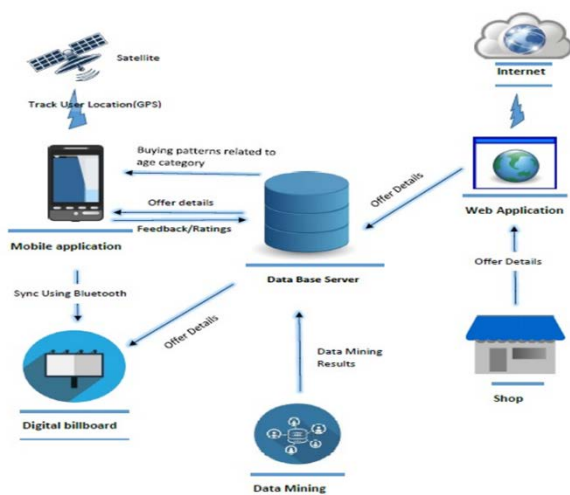
Figure 1 High Level Diagram

C.   . Implementation

Following are the tools that were originally decided to be used to build the system; Web Browser, Adobe Dreamweaver, Android Studio, MySQL, MySQL Community Server, Business Intelligent Studio, Visual Studio 2015, Arduino and Visual Studio 2012.

Due to several changes and complications, in the system in later phases, additional tools listed below were also used to develop the system.
•   SQL server 2016
•   NetBeans IDE 8.1

An Arduino Mega 2560 was used along with a HC-05 Bluetooth module and an LCD screen to display offers for demonstration purposes.

D.   Testing

Testing phase was focused on checking the system and identifying the system errors thus fixing them to provide the system with a better quality, performance and accuracy.

IV.   RESULTS AND DISCUSSION

A.   Results

This section covers the results of our system and the new approaches found to address issues and further research in the context.
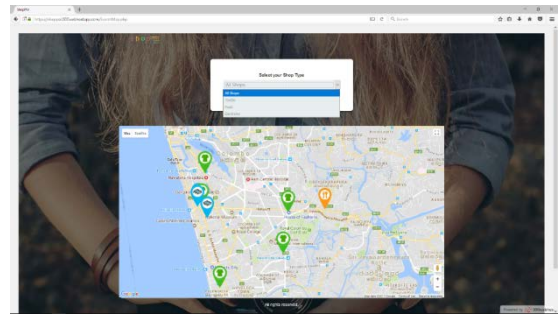
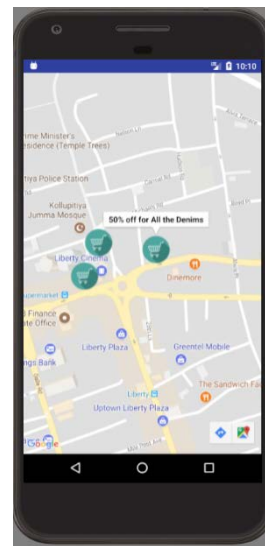Figure 2 Web View Other offers Interface
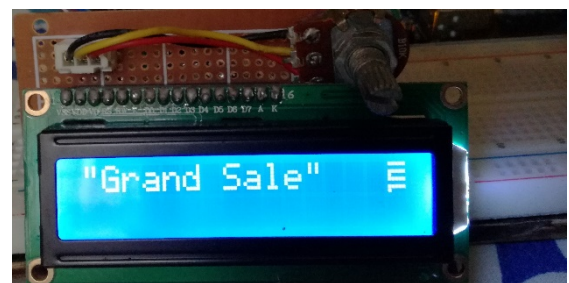

Figure 3 Display Offer Details Interface

Figure 4 Display offer details on LCD

Figure 5 Data Mining Result

Figure 2 depicts the interface that allows the shop owners to view offer details of all shops around his location. Figure 3 shows the mobile interface that shows the user offers based on his location and preferences. The offer details according to the age category of the majority is displayed on a billboard and this is depicted in Figure 4. The data mining results are shown in Figure 5. It displays the top five user preferences according to specified age categories.

The shop owner adds an offer detail to the system via the web application. He can view related offers in the area through the use of the interface given in Figure 2. A desktop application is used by the cashier to enter details that are required update the mining model. The mobile user when downloading the app, will have to state his preferences. The preferences are suggested to the user with the use of the result of a stored procedure as depicted in Figure 5. The mobile app will track the user location and depending on his desired preferences, if there are offers available, will display it to the user. This is done as depicted in Figure 3. The billboard will read the age category of the majority of users connected, and taking the majority into consideration, will display offer details related to the majority as depicted in Figure 4. The offer details will contain the name of offer, offer description, and image of particular product. For demonstration purposes, an LCD screen connected to the Arduino was used and shows the offer title.

B. Discussion

ShopPal contains functioning components as a mobile application, web application, desktop application and a billboard component. Each component has been tested in isolation. After stabilizing all the modules each of them were integrated together and tested again until the complete system is error free.

The system started with the decision of having a mobile application that contains location-tracking and notifying the users on preferred offers. This was decided to be combined with a parking slot detection service that notifies the customer on parking slot availability along with the offer notification. Due to certain complications, the parking slot availability service was replaced with a billboard component. For demonstration purposes, a decision on using the Arduino board with a Bluetooth module was put forth. The web application too was added a new functionality wherein the shop owners could also view similar offers in the area. Market Basket Analysis was proposed to find common preferences of customers in different age categories but after research analysis, a stored procedure was used for the same. The main intent of the system is to notify the target customers on offer notifications based on their current location and also one that would detect users in a crowd, work out the buying preference of the majority of them and display the content on the public display. Therefore, using this system the users will be able to get offer notifications with no hassle.

During the development period, the team had to face some technical and logical challenges. Following are some of the major challenges faced by the research group.

- Database used for data mining had to be accurate in order to get an accurate mining result.
- Lack of signal when syncing the billboard with the mobile application.
- The use of an Android version that supported the Google API.
- Complications in demonstrating the billboard component.

To avoid the listed problems, the team had to seek for support from other individuals and related tutorials and books.

The accuracy of the system depends on the strength of Bluetooth connectivity and also the signal strength and mobile data present at the time.

V. CONCLUSION

"ShopPal – Best Offers at Your Fingertips" will be a better solution that will provide its users a hassle-free shopping experience with the combined effort of a mobile application, web application, desktop application and a billboard component. The four components integrated into a single system provides its users an error-free, accurate offer advertising service.

The system will undoubtedly be greatly beneficial to both consumers and shop owners and "ShopPal" can be considered an ideal location-based offer advertising system that would give consumers a hassle-free shopping experience.

There are some limitations to be highlighted in "ShopPal'.

➢ The mobile user should use android OS and use GPS technology to use the services.

➢ An internet connection is required to use the services. Since the application fetches data from the database over the Internet, an internet connection is crucial.

➢ Both the web site and the mobile application will be constrained by the capacity of the database. Since the database is shared between both application it may be forced to queue incoming requests and therefor increase the time it takes to fetch data.

➢ Since the project team uses Bluetooth to sync the billboard, there may be lack of signal.

➢ Since the application makes use of GPS technology, it would be not suitable for shopping malls that extend over multiple floors because GPS would not be able to track the same.

VI.   FUTURE WORK

➢ The mobile application could convey the availability of parking slots along with notifying the user on particular offers.
➢ The gender attribute could be considered along with the age when predicting promotions for the billboard.
➢ The system could introduce a way to track offers available in shopping malls that span multiple floors.

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