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A Literature Study on Local Based Marketing and Related Technologies

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Abstract

With the increasing technological developments and the spread of e-commerce, the concept of local marketing has increased its importance and application area. With this method, companies were able to reach more customers through electronic media and were able to go beyond trade trapped in a certain region. In addition, consumer confidence in technology has made local-based marketing (LBM) more efficient and life-saving. LBM is more preferred for shopping and brings consumers closer to brands. Thanks to advanced technology tactics such as GPS (Global Positioning System), Beacon or bluetooth sensors, this online process has been even more successful. In this study, it is aimed to present the concepts of local based marketing, global positioning system and beacon technologies in the current literature and present different applications and technologies related to the subject.

Keywords: *LBM (Local Based Marketing), GPS(Global Positioning System), Beacon, Bluetooth.*
JEL Codes: *O14, O32, O33*

Yerel Tabanlı Pazarlama (LBM) ve İlgili Teknolojiler Hakkında Bir Literatür Çalışması

Özet

Artan teknolojik gelişmeler ve e-ticaretin yaygınlaşmasıyla birlikte yerel pazarlama kavramı da önemini ve uygulama alanını artırmıştır. Bu yöntemle, şirketler elektronik ortam üzerinden daha fazla müşteriye ulaşabilmiş ve belirli bir bölgeye sıkışan ticaretin ötesine geçebilmişlerdir. Ayrıca, tüketicinin teknolojiye olan güveni, yerel tabanlı pazarlamayı (LBM) daha verimli ve hayat kurtarıcı hale getirmiştir. LBM alışveriş için daha fazla tercih edildiğinden tüketicileri markalara da yaklaştırmaktadır. GPS (Küresel Konumlandırma Sistemi), Beacon veya bluetooth sensörleri gibi ileri teknoloji taktikleri sayesinde bu çevrimiçi işlem daha da başarılı olmuştur. Bu çalışmada, günümüzün yükselen eğilimleri olan yerel tabanlı pazarlama, küresel konumlandırma sistemi ve beacon teknolojileri kavramlarıının güncel literatür bağlamında sunulması ve konuyla ilgili farklı uygulama ve teknolojilerin tanıtılması amaçlanmıştır.

Anahtar Kelimeler: *LBM (Yerel Tabanlı Pazarlama), GPS (Küresel Konumlandırma Sistemi), Beacon, Bluetooth.*
JEL Kodları: *O14, O32, O33*

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1. Introduction:

In this study, it is aimed to introduce Location Based Marketing (LBM) together with the related technologies such as Global Positioning System (GPS) and Beacon Technologies which become unavoidable in many areas of our daily life and to present different application areas of these technologies from the current literature. In this context, firstly the brief historical and technical information related to these technologies will be given, and then followed by examples of various works related to the these technologies.

2. Location Based Marketing (LBM):

We are in a period where location-based marketing is more preferred by smartphones and mobile applications. Companies can now reach their customers in a shorter time and more easily, and customers can effortlessly communicate with the brands or companies they want. People report where they are, and the sellers reach the consumer in the right place and at the right time. Location based marketing transmits the opportunities of brands to a wider audience. In this way, they have the opportunity to attract customers from different regions.

Customers' location was no longer a matter of concern to the sellers. Because it is directly related to where you are and what you need or what you can buy. Trading always involves competition. So every information about the customer is like gold in terms of sellers. It is a perfect opportunity for sellers to learn about a customer's tastes, which idea they have, especially where they travel, where they eat and where they have fun.

Wireless communication technology, which enables devices to communicate with each other, is one of the technologies that continues to be developed for this purpose. BLE (Bluetooth Low Energy) technology, which aims at low energy consumption, has emerged

as a result of this development. There are many devices using BLE technology and many new technologies based on this technology. One of them is Beacon technology. Beacon is a technology that provides location information using BLE technology. Access to location information can be provided by using BLE signals from a device using Beacon technology. Depending on the distance, this technology can communicate the desired information to the devices it interacts with. Beacon technology can be used for different areas such as interior navigation, close marketing, automatic check-in, contactless payment, and recently, many studies have been carried out on this subject (Gülağız et al, 2016).

In location-based marketing, many awarding or promotion methods are used to encourage customers to shop. These opportunities meet the customer through the message. While this is an advantage, but it may turn into a disadvantage for sellers if it is used incorrectly. We must not forget that excessive amount of everything is harmful. If these messages overwhelm the customer, they will be uncomfortable and they will want to get away from it. So customers will not want to see the notifications of the enterprise. In this way, the seller would have suffered great loss. Because the customer's buying behavior will be adversely affected. The solution can be solved by the fact that the control is in the customers. Nothing should be strained and the customers should act as they wishes.

Not being ordinary is very important in this business. The more companies learn about their customers' needs and how they use location technology to shop, the applications will be exactly what they need. Confidence against the brand is a great success.

The purpose of the location-based service is to deliver to the consumer in a short time and effectively. Some of them make their own advertisements by making suggestions to social media and others on different ways. This a kind of remind themselves. Local marketing has become the sine qua non of the electronic world. And advertising online is quite low in terms of cost as well as in terms of strategy.

3. Some Of The Technologies Contributing To Local Based Marketing:

GPS, which has an important place in local-based marketing applications, is a space based radionavigation (radio-radio waves) system that allows people to determine a geographical location in the world or their position on earth.

The GPS system, which was invented for military purposes but is today a part of our daily lives, is also prevalent among individual users. In addition to the question "Where am I?", the question of "How to go?" can also be answered by the GPS and it is now possible to see this system almost every phone and every car. The basic operating principle of the Global Positioning System is to measure the distance between these satellites and the satellites system where coded information is regularly sent. While the three circles intersect at one point or four spheres at one point, the system is able to determine the exact location on the earth by measuring the distances between the satellites and this makes the process

almost flawless even if it is not as sensitive as it is for military vehicles (Açık Bilim, 2019).

GPS framework, which turned out to be completely operational in 1995, comprises of satellites that are continually progressing in their circles, working with 24 satellites currently by the US Department of Defense. The framework, bolstered by the Department of Defense, is available to everybody for use with a GPS receiver. The satellites emanate a sort of radio signal, and the GPS collectors on the earth get and translate these signals to decide their position.

There are few variables affecting quality in position determination. These prohibitive factors can be listed such as forests, tall buildings and tunnels, the location of satellite receiver, the faults due to atmosphere (deterioration of signal quality), and the the type and power of the receiver. GPS satellite signals can be received in non-closed areas. Since satellite signals cannot be received in closed areas and frequent forested areas, it is impossible to determine the position with GPS. Various strategies and advancements have been created to get position data in places where there is not sufficient GPS signal. One of these technologies is the Beacon technologies that give particular information up to a certain distance, which works with bluetooth low energy technology.

Bluetooth Wireless Technology is a short-range (up to 10m) wireless networking method for individual, office and industrial environments. The Bluetooth Standard should join individualized computing gadgets. The improvement of the Standard originated with the development of a Bluetooth Special Interest Group (SIG) by IBM, Intel, Nokia and Toshiba in 1998. They went for a worldwide standard, which was at first received by 70 SIG members, and increased to 3000 SIG members by end of 2001 (Davies, 2002).

Bluetooth systems transmit information as low-control radio waves. It imparts at a recurrence at a frequency of 2.45 gigahertz (actually between 2.402 GHz and 2.480 GHz). This frequency band is reserved for the utilization of industrial, scientific and medical devices in international agreements (Turksan, 2019).

Bluetooth innovation is being grown increasingly more consistently. With Bluetooth 4.0, which was presented in 2010, this technology has been renamed and named BLE (Bluetooth Low Energy). With BLE, technology was reestablished with lower data transmission and lower creation costs. In this way, data transfers can be made without the requirement for constant connection between devices with lower energy consumption. Bluetooth Low Energy (BLE) is an exceptionally low power, generally short range (50m) innovation that guarantees sensors to have the option to convey utilizing a coin cell battery even as long as two years (Siekkinen et al, 2012).

There are three key contrasts between BLE technology and Bluetooth technology. These are; battery consumption, fixed pairing and re-pairing. BLE technology is designed for small data transfers in short time frames. It does not bolster long-term data transfers, as in older adaptations of Bluetooth, and plays out a few byte data transfers over short periods of time. Along these lines, it diminishes the vitality utilization by changing to rest mode when not being used. As of late, a new device that rose with the advancement of

BLE technology and conveying using BLE technology has developed. This device is called Beacon. (Gülağız et al, 2016).

Beacons are transmit a low-power signal that can be grabbed up by nearby Bluetooth-enabled mobile devices, including cell phones. Beacons themselves don't gather information. They communicate short-range signals that can be identified by applications on cell phones in closeness to a beacon. Beacons situated close to an air terminal security checkpoint, for instance, may trigger an airline application to indicate a boarding pass. A beacon next to a painting in a museum may signal the museum's application to give information about the artist. Retail location beacons can enable users locate products or show on-sale items. Library beacons can be useful for reminding users about late books. Beacon signals won't be received unless users have installed applications that are related with those beacons (i.e., the airline application, a museum application, a retail location application, a library application, etc.). Device owners should also have enabled use of Bluetooth. (Sterling, Polonetsky, & Fan, 2014).

Beacon devices are low-power and low-cost electronic transmitters furnished with BLE technology, also known as Bluetooth 4.0 or Bluetooth smart. The beacon device (BLE) provides communication at a data rate of 1 Mbit / s utilizing the Frequency Hopping Spread Spectrum method in the 2.4 GHz frequency band, such as Bluetooth technology. However, power consumption is extensively lower than other Bluetooth adaptations (Bayılmış & Özdemir, 2016).

Beacon devices discharge wireless signals at a given frequency, called a Bluetooth packet (BLE Advertising). These signals are received by cell phones with Android and iOS operating system supporting BLE. Applications in mobile devices are worked with remote signals from beacon devices. Accordingly, mobile applications work just when the inclusion of the beacon device is entered. This situation provides extraordinary comfort to the clients. (Köhne & Sieck, 2014).

IOS operating system pointer devices are called ibeacon. Google Beacon With Eddystone's technology, BLE provides a significant innovation in the pointer field by bringing the URL execution feature in addition to the mobile application interaction in the pointer field. (Bayılmış & Özdemir, 2016)

Low energy Bluetooth beacon technology (Bluetooth Low Energy - BLE) is a low power consumption model of the traditional bluetooth standard. The power consumption of devices using conventional Bluetooth technology is approximately 30 mA, while power consumption is less than 15 mA for devices using BLE technology. Due to this low power consumption and low power sleep modes, BLE devices can operate for many years. (Arsan, 2018)

BLE pointer (beacon) technology is used for indoor applications to detect proximity to the BLE beacon instead of full positioning. For this reason, this technology is more common in museums and closely related marketing applications, such as automatic check-in and contactless payment. In indoor positioning systems, it is usually used in conjunction

with navigation, and is actively used in polling systems. Precise positioning of the interior using the BLE pointer (beacon) has increased over the last five years. The indoor position is determined by the limited range of each beacon, and the user's position information is obtained from the intersection of all BLE beacons in the coverage area. The average error in indoor positioning systems based on BLE (beacon) is generally in the range of 1 m - 2 m. (Kriz, Maly, & Kozel, 2016)

The most common reason for the widespread use of Bluetooth is wireless and cheap. It also works automatically. And it can work without failure in no internet connection. So when we compare it with GPS, we see that bluetooth-based beacon technology is more useful.

4. Literature Review

Rouhollahzadeh and Bhatia (2001) presented an invention which suggests some methods of collecting and analyzing mobility information regarding mobile subscribers and providing this mobility information to telemarketing companies to generate extra revenue for cellular network operators. They are saying that a telemarketing application can define a target area, which includes a cell or a number of cells that are of interest for the telemarketing application, and include this defined target area in a mobility request to an Operation and Support System (OSS) within the cellular network. The OSS tells Mobile Switching Centers (MSCs) within the target area to log the movement of each MS located in the target area and record this mobility information in a Home Location Register (HLR) or Visitor Location Register (VLR). When the Mobile Switching Centers obtained the mobility information, this information is sent through the OSS and could be added some filter parameters according to the preferences of the telemarketing application. By this way a tailored mobility information is generated and can be used by the telemarketing companies in order to reaching specific MS's for telemarketing advertisements.

A personalized advertising system is formed by combining Global Positioning System (GPS), Personal Data Assistant (PDA), and wireless communications. The aim of this invention is creating and advertising content depending on personal user profiles concentrating on the physical geographic location of a customer. By this way the problem of finding customer's profile and current location is found and the advertising. Also, the invention integrates location tracking, GPS technology, with a personal electronic calendaring System. Further, an advertising message is more personalized customer's location. This information be provided in the form of driving directions, using the current physical position of the user as a start address(Kraft, Ford, & Cao, 2002).

The technologies mentioned here are not only limited to the applications which are used for the purpose of increasing the sales of the brands or reaching more customers, but are also frequently preferred for the realization of innovations that bring functionality and convenience in many areas of daily life.

In the work of Gülağız and his friends, it was provided to develop a mobile application

in any environment by using Beacon labels or to provide control of the items which are valuable for us. The developed application is Android-based and works by providing users with sound and visual stimulation within a certain distance for devices with a Beacon label. (Gülağız et al, 2016)

Mori and his friends placed some bluetooth signaling devices around a room. They have observed RSSI values of these markers to determine whether an item is in the room. The error rate of 2.4 meters has been achieved, but the information on whether the item is in the room has been reached correctly. (Mori et al, 2015)

Shota and his friends used this system to take attendance. Students use their personal android devices to scan their ID cards and register for the course. In a classroom where a lot of students take a course, it takes a long time for the attendance paper to give hand to hand, and also the accuracy of the check cannot be controlled. This system is both shorter and the accuracy of the attendence can be controlled. In addition, the copying of exam periods is prevented. (Noguchi et al, 2015)

Another study was conducted to reduce the energy consumption of electrical appliances in an office. Beacon sensors are used to determine whether an employee has entered the office or not. Thus, the energy used by office lights, PCs and monitors is minimized. (Choi, Park, & Lee, 2015)

Kuzmics and Ali(2018) introduced a system that has been developed to find people in buildings in crisis situations by using personal Bluetooth low energy devices. These situations include earthquakes, collapse of buildings, fires, explosions, terrorist activities, etc. It is used to find and locate the victims of emergency services. It uses hardware and software-based solutions to track people in need using BLE signals from users' devices.

Elderly care is important but difficult. Because older people forget to move positioning devices and hate it. In this case they developed an application that does not require equipment. A human motion detector is required for localization without a device. The Bluetooth pointer is a new positioning device that uses Bluetooth 4.0 (also known as Bluetooth Low Energy). If the received signal strength indicator (RSSI) falls below a certain threshold, the system detects that a subject is near devices. (Sugino et al, 2015)

Hiramatsu and friends have developed a new smartphone app to help tourists using Bluetooth Low Energy (BLE) technology. Not only does the practice guide a specific place, but it also explains the traditions and history of the region. His experiments at Nikko, one of the world's heritage sites in Japan, show the effectiveness of the BLE sign for travel, especially for foreign visitors and young Japanese walking around the area. The application displays information close to each mark. Signs on the road to the main temple give information about the local tradition and its history. (Hiramatsu et al, 2016)

Intelligent tour guidance services are provided in many museums, allowing visitors to get detailed information about exhibitions through mobile devices. This study uses indoor positioning and application to provide visitors with instant tour guidance, so visitors can be more informed in a fair way. In addition, museum staff can request information

and even provide emergency assistance to those in need. The Global Positioning System (GPS) is mostly used in mobile applications, but the positioning accuracy is reduced due to the reduced signal strength of the building materials. As a result, indoor positioning technology has been proposed. Indoor positioning technology is based on wireless sensor networks, including technologies such as WiFi, Zigbee, RFID and Bluetooth. (Chou & Hung, 2016)

A reliable estimate of the occupancy of a site can be useful in a wide range of applications, particularly in relation to emergency management. For example, it can help identify priority areas and effectively deploy emergency personnel. However, occupancy detection can be a major challenge in indoor environments. A new technology that can be very useful in this respect is Bluetooth Low Energy (BLE), which can provide the position of a user using information from the beacons located within a building. (Filippoupolitis, Oliff, & Loukas, 2017)

In recent years, some aircraft crashes, debris and recording devices have lasted for quite some time, and some have still not been found. When a plane flying over the ocean falls, it starts to sink structurally. GPS, radar and flight plan information can help to predict the final position of the aircraft. But it is unlikely that this estimate will be a point. In addition, even if the end position of the aircraft is 100% accurate, this information does not indicate the depth of the wreck. This makes the search and rescue work very difficult, especially in deep ocean waters. When the ULB (Underwater Locator Beacon) starts to emit signal, search and rescue teams located according to the most recent position estimation of the aircraft try to determine the position of the aircraft. (Kıvanç & Ürgün, 2018)

Mobile transfer unit was designed especially for elder and Alzheimer patients. This module is matched up with the smart breaker, contains BLE 4.0 module and can be reduced to the dimensions of a key. It has low level power consumption like beacons. Its battery can be used for years. The target of this module is to detect when the person leaves home for a long duration. For instance, when an Alzheimer patient leaves home, and a heater is left open, the system detects that and closes the switch that is connected to the heater. The system can also be added with a vibrating and audible alert. The job that this unit does can be done by smart phones and tablets. However, it is evaluated that it may be a more effective solution for the elderly and needy patients. (Böbrek & İlkuçar, 2017)

Bluetooth low energy (BLE) beacon technology is a cheap and an emerging technology that offers successful solutions in many indoor positioning systems. In this study, an indoor positioning system using BLE beacons was developed and it was aimed to increase the accuracy level of the standard equipment with the additional algorithms used while reducing the average error. For this purpose, the Big Bang – Big Crunch (BB-BC) optimization method has been applied to the experimental indoor positioning system and the positive effect on the measurement accuracy has been proved by the tests made. An area of 37.44 m2 was selected as a test area of 9.60 m × 3.90 m and fingerprinting algorithm was applied to twelve grid areas with dimensions of 2.40 m × 1.30 m. Four BLE

beacons were placed in the test area and a total of 9,000 measurements were made for 150 seconds from twelve test points. The measurement results were improved by using the Big Bang – Big Crunch optimization algorithm with Euclidean distance matching method and Kalman filter, where the accuracy increased from 26.62% to 75.69%. (Arsan, 2018)

For successful implementation of the New Ways of Working (NWW) office, it is necessary to plan on the basis of user-identified space usage information. Of the different methods, a trilateration-based Bluetooth low-energy (BLE) Beacon system has a greater potential as it provides specific location information. However, the feasibility of implementing a trilateration-based BLE Beacon system has not yet been validated in space-usage analysis in the NWW office. The present study thus aimed to establish whether such a system would be suitable for the purpose. Two sets of experiments were performed in an open-plan office in order to evaluate system accuracy. Methods of estimating indoor space usage were comprehensively reviewed. The feasibility of a trilateration-based BLE Beacon system was validated. Overall distance difference between estimated and actual locations was 1.78 m.The Beacon system's estimation accuracy was inadequate for the NWW office. Potential solutions for improving the system's estimation accuracy were proposed. (Baek & Cha, 2019)

Conventional Radio Frequency (RF) based fingerprinting still remains one of the most popular methods among other indoor positioning techniques due to its inherent accuracy and reliability. In this paper, we conduct a study to infer if a reduced number of receivers equipped with higher gain antennas can provide improved Bluetooth Low Energy (BLE) fingerprinting performance in a complex indoor environment. The evaluation is performed in a standard domestic apartment with an activity centric approach using a single wearable beacon and multiple receivers. A rank based route selection algorithm is used to list the candidate positions or routes that indicate the most likely path on which the subject was travelling. Furthermore, we discuss the benefits of implementing the inverse fingerprinting method with a trajectory based prediction model and also examine the effect of surrounding electrical interference. Experimental results indicate that an increased antenna gain in addition to deploying an adequate number of receivers have a positive effect on the overall ranking accuracy. (Bodanese et al, 2019)

Sudarshan describe a method for determining the location of a mobile device, such as a handheld computer or mobile phone, in an indoor environment using Bluetooth beacons. Since it uses inexpensive commodity devices, this method is inexpensive to deploy. The limited range of Bluetooth reception is used to advantage. Another important advantage of this method is that it allows the mobile device to determine its location while remaining anonymous, unidentified to the beacons or other nearby devices. In such a deployment, an important design task is the placement of beacons. Signal propagation in indoor environments is complex, affected by factors such as floor-plans and duct-work, varying transmission and reflection properties of building materials and furniture, and interference from other devices. Therefore, the area from which a beacon is visible is very irregular and not well approximated by simple models, for example, ellipsoids. Sudarshan's

answer permits complex reception characteristics to be precisely modeled and gives a straightforward technique to picking beacon locations (Sudarshan, 2008).

Sicitiu and Ramadui (2004) are saying that wireless sensor systems can possibly turn into the pervasive sensing technology of the future. For some applications, an enormous number of cheap sensors is over a couple of costly ones. The large number of sensors in a sensor network and most application scenarios preclude hand placement of the sensors. Deciding the physical location of the sensors after they have been sent is known as the issue of localization. They presented a localization procedure based on a single mobile beacon aware of its position (e.g. by being equipped with a GPS receiver). Sensor nodes accepting beacon packets infer proximity constraints to the mobile beacon and use them to construct and maintain position estimates. The proposed scheme is radio-frequency based, and thus no extra hardware is necessary. The precision (on the order of a few meters in most cases) is adequate for generally applications. An implementation is used to assess the performance of the suggested methodology.

5. Conclusion:

In conclusion, the technological developments continue to increase day by day, bringing innovations and facilities in every aspect of life. Local-based marketing has become an indispensable commercial choice by making it easy for brands to reach customers through the help of different discoveries such as GPS and Beacon technologies. Thanks to the convenience of these technologies, not only in the marketing sector but also in many different sectors from education to health, since they are improving their areas of use by making many applications that require manual effort and have high level of error before, much more efficient and safe. Within the scope of this study, it is aimed to introduce facilitative technologies such as GPS and beacon via local marketing example and some other implementation fields and to provide awareness about these technologies which will increase their effects on human life in the near future.

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