

Enhancing User Experience for Sustainable Fashion through QR code and Geo-Fencing

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Abstract: Fashion industry is second largest pollution generator, after oil industry. There are various reasons for this, user awareness and affordability for the sustainable fashion is also one of the reasons for the same. There are very less fashion store, which provide the full information about fashion related product to user. Or sometime information is available in such a lengthy manner, that user don't want to access. In this paper we are discussing about a model based on mobile application, which will work on the concept of Geo-fencing and QR code in a coordinated manner, and this will help to enhance user experience. There is a continuous growth on mobile phone users which also provides an easy and affordable platform to user and vendor both to know more about each other, which helps vendor to offer, personalized services as per user interest and user can also get easily all information in his/her mobile. Geo-fencing sends notification to all users who are in range of geo-fencing. Once user is in store, user can get all details about product with the help of QR (Quick response) code installed at the location product. In store mobile application also helps to find location and navigates user to product location. At any point of time, mobile application is not working or in process any stage is not working, immediately a notification will be sent to sales team, so that they can help user. As QR code can store approximately 3-4 MB of data that is good enough for storing information about product. This will help user to know more about product sustainability for environment, which will be equally good for his/her health too.

Keywords: Sustainable, QR code, Geo-fencing, Fashion Industry, Mobile application

I. INTRODUCTION

Fashion may be entitled as life or wearable art, when worn it reflects creativity, innovative, personality and connected with historical, cultural images of the past and current trends of the world. Changing wardrobe is the fastest route for one's satisfaction. Fast Fashion can be stated as luxury not necessity, where the wardrobes can be replenished according to the situation. [1]

The fashion industry is loved and recognized for its innovation, its style and its power as a cultural and societal measure to reflect our changing world affairs through styles with new silhouettes and trends.[2]

The global luxury fashion industry, which includes, Apparel, fashion, make-up, fragrances, watches, jewellery and handbags has been rising over the years. The worth of the worlds fashion industry was 241 billion dollars in 2013 and was about 283 billion dollars in 2016. As social media is bringing more accessibility and accountability to fashion

industry, large group of both manufacturers and customers are bringing new life to the industry in the global market.[3]

The expected revenue growth in the fashion segment amounts to US\$68,332m in 2019 (Fig.1).

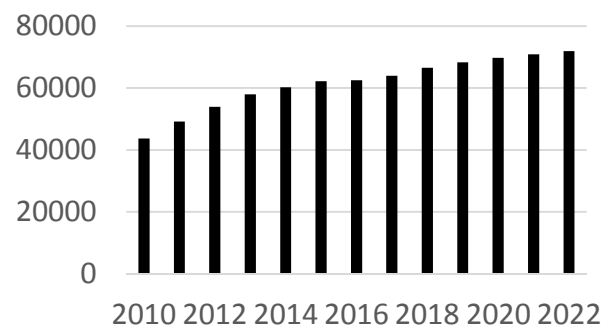


Fig. 1. Growth of Fashion Industry in US\$

The market is supposed to grow annually by 1.7% (CAGR 2019-2022) (Fig.2). In global context, most revenue is generated in the United States (US\$18,751m in 2019). Fashion is the way in which one can express him/herself in their clothes. It may reflect one's mood or attitude. Fashion depicts social, economic, and cultural changes. It is more of an individual than environmental interest.

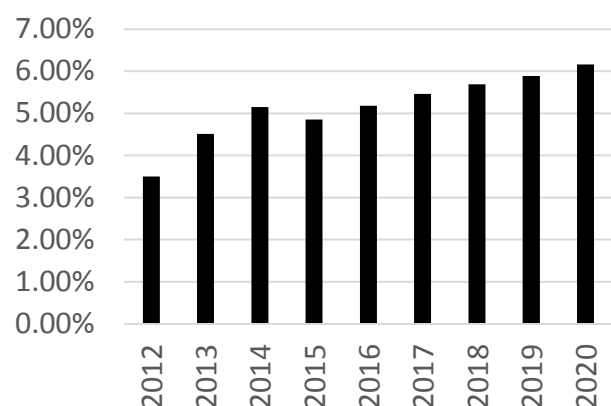


Fig. 2. Market growth of the apparel industry worldwide

Fashion or we may call it as fast fashion which mimics or copies the recent luxury trends targeting the young consumers of the world leaving great impacts on the global environment. The changes in trends are like the speed of light which leads to the piles in the landfills. Can fast fashion, with allegedly stress on authenticity, and its collateral respect for artisans and the environment, and promote values of both sustainability and quality of the products? We perceive that if the manufacturers are forced

or stressed to adopt “Green” practices it may help to integrate the values of fashion with best practices for environmental sustainability. [4]
Sustainability may be defined as “Avoidance of the depletion of natural resources in order to maintain an ecological balance.” Sustainable fashion can be referred as echo fashion or green fashion. [5]

Fashion Industry is to be blamed majorly for emission of greenhouse gases which is causing the global warming. It is the second largest polluter in the world, just after the oil industry. The clothes which are discarded or unused pile up in the landfill sites and the fibers that are released during the wash pollutes the sea. Table-1 represents fashion related facts which are affecting environment.

TABLE-1 FASHION FACTS AFFECTING ENVIRONMENT

Clothing items sent to land fills	235million
Fibers to sea	700,000
Carbon emissions	1.2billion tons
Water used to wash Denim	3781 liters

Untreated toxic wastewaters from textiles factories are directly dumped into the rivers and sea. This contaminated water eventually spreads around the world. It takes more than 200 years for synthetic fibers (72% of our clothing), also known as plastic fibers to decompose. Heavy use of chemicals during fiber production, dyeing, bleaching, and wet processing leads to various diseases and premature deaths around the globe, also leading to soil degradation and water pollution. The loss of ancient forests due to cutting down and replacement of trees by plantations of trees used to make wood-based fabrics such as rayon, viscose, and modal is threatening the ecosystem. [6]

However, we can find alternative solutions to minimize these problems by adopting green practices:

Reduce waste: Minimize or zero waste while pattern making and marker making for increased efficiency which results in cost savings for the manufacturers. Recycling repair or maintenance services develop products that can last long, for more than one season.

Reduce water and energy consumption: Selecting proper material for manufacturing which may lead to optimum utilization. Such as organic and recycled material. Provide technical coated fabrics which may reduce laundering during the customer use period.

Reduce use of chemicals and impacts caused: Selection of proper material (fabrics) and raw materials that are organic in nature (free from pesticides and chemicals). Follow (RSL) Restricted Substance list which considers health impacts to workers while working in the manufacturing unit. Use of chemical technology should be replaced by Mechanical technology.

Emphasis on increasing ethical production: Support workers’ rights by incorporating traditional, local and global crafts skills. Collaborate with organizations that promote workers right and environmental governance. Implementation of practices and policies for the suppliers

that may increase transparency and accountability in the supply chain.

Product life Cycle Management: Selection of materials or fabrics that can be upcycled or recycled. Use of blended materials should be avoided as it is difficult to separate them. Introduce features which can be replaced, repaired or upgraded for longevity or durability of the product. Use of latest technology Technologies like Nano should be used on fabrics for durability and chemical free. Laser cutting, welding, digital printing for clean finishes. Production of closed loop materials.[7]

More than 85 companies and other government organizations are using Global Reporting Initiative (GRI) guidelines in the Middle East region. G4 version of guide lines in Arabic translation has been launched for tracking the sustainability reports from every organization, which allows to monitor the performance on dozens of the most critical sustainability of hundreds of data points.[8]

Further, consumers of the world show interest and respect to ethical buying but they are not willing to compromise on their vital identity which makes them resistant to change.[9]

Although young consumers around the globe think green but they do not contribute in a sustainable manner. Hence, they should be urged to optimize the ecological textile chain and develop a consciousness for the Fashion industry. [10]

II. MOTIVATION AND CHALLENGES

Customers do not seem much interested to purchase sustainable fashion as there are not many choices available, they lack aesthetics and functional properties in the design, consumers are also less informed about the product and are not much aware of the benefits towards environment. Most of the consumers are price focused and look for value for money. It is difficult but not impossible to educate the global consumers to embrace sustainable fashion. Recent report has shown consumers are becoming conscious of what they’re buying. Ethical spending now accounts for £81.3 billion of the UK retail market, according to Ethical Consumer, and KPMG’s annual retail survey indicates that approximately 20% of shoppers were drawn to retailers that they know ethically source their goods.[11]

High street fashion brands like, Zara and H&M have launched ethical lines, shoppers who are conscious about sustainability and frustrated with fast fashion brands. Customers are considered as a “King” in the retail business, is the main reason why organizations focus on customer satisfaction, loyalty and their retention. Some of the businesses even go out of the way to pamper their customers. In a fashion store where the factors like style, silhouettes, colors, size, quality, blends, and trends are involved, not all customers have enough knowledge while they are purchasing. This may either lead them to buy wrong products or consume a lot of time to decide on their purchases. Some of the problems faced by the consumers in the fashion retail stores are-

Choice of Detergent: The customers are not aware that use of a laundry detergent that is eco-labelled and free from hazardous phosphates, will contribute to the enhance growth of aquatic vegetation of our lakes and seas. One should avoid using liquid detergents and choose powdered washing detergents. Liquid detergents may be allergic as they contain more preservatives.

Avoid Fabric Softeners: Generally softeners are used for fragrances which may carry hazardous surfactants and are allergic in nature. These may be harsh on the environment and difficult to break down for water treatment plants. Customers should look for eco-labelled softeners.

Avoid Air-dry Laundry: Tumble-drying or hanging laundry in drying cabinets should be avoided to save energy. Machine drying can reduce the life span of the clothes.

Avoid Dry cleaning: Due to the use of chemicals and strong detergents dry-cleaning methods can have harmful effects on the environment. Customer should initiate in finding out “greener” or ecofriendly methods for dry-cleaning alternatives.

Avoid polyester Blended fabrics: Most of the customers are not aware polyester and its blends are made from plastics which takes hundreds of years to decompose leading to polluted environment.

Product location: The customers are not aware of where the product is available in the stores, which involves lot of their time. iPhone has launched an application for locating products in specific place in the retail store. This application also supports product search feature along with voice recognition technology. Such applications are limited to the participating stores only and currently work on toy stores, drug stores and grocery chains. . Such kind of application are not yet being used in a fashion retail store to help locate the right size, trend, style etc..

Knowledge about store: Most of the customers are not aware of the products that are available in the fashion store. For example, Nayomi, which is a lingerie store but has products like fragrances, night wear, skincare etc..

III. LITERATURE REVIEW

Technology has been immersing rapidly in the fashion world, it is difficult to ignore the impact of technology. Thus, there is a rapid shift from brick-and-mortar retail shopping to ecommerce. Technology is changing all sectors of businesses with the use of AI, VR, data analytics etc.[12] Internet of things (IOT) is one of the biggest opportunities which is capturing the fashion retail Industry. With internet this technology automates our world by helping us to keep in line with everyday objects. [13] The world of technology is leading towards a drastic change in the fashion industry. Recent study states that 70% of global retail decision makers adopting the IOT to improve customer experiences and needs. Apparel items such as yoga pants and NADI X, have built-in sensors which brings together design and technology to create a better quality of life through

experience and fashion. [14] Artificial intelligence (AI) is a branch of computer science dealing with simulation of intelligent behavior in computers.[15]

The buzzword that is sweeping most sectors of the retail industry across the globe is Big data – Fashion business is also a part of this. In fact, the retail businesses are immersing themselves into the digitalization trend and are using these technologies to their benefit. These days’ social media is ruling the web world and is providing shoppers the floor to shape trends. Unknowingly the customers are helping the retailers in providing them goldmine of data which is used to project trends and minimize the gap between the production and items that are sold. Therefore, AI is being used by the retailers to collect, analyse, sort and organize data into appropriate categories which can be later used to anticipate customer preferences. Screenshop is an app created by Kim Kardashian which demonstrates the use of AI image recognition on the phone selected from Instagram and guide the customers to find similar items at affordable price. This app has been partnered with brands like ASOS, Topshop, Forever21 and Saks Fifth Avenue.

Growth of smartphone: As we all are aware that internet has now captured the market and easily available everywhere. Growth of smartphone (Fig.3) has significantly impacted buying and selling of the products via Mobile platforms. Mobile phones are now squeezing its way into the business world with digital wallets, clearly states that our everyday lives have a great impact because of social media apps, and communication apps, In today’s world, mobile commerce is an easy and smoother option for payments through smart phones, Digital wallet like, Apple and Android pay options. This new technology driven buying method makes shopping easy and simple by clicking on a button. For example buying through the shopping feature in Instagram. [16]

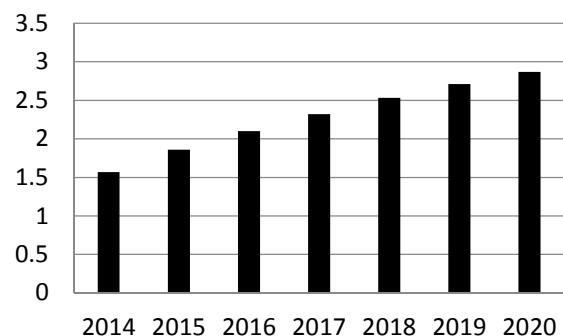


Fig. 3. Growth in uses of smart phone (in %)

Virtual/augmented reality (VR) - Introduction to the digital world was brought by Mobile applications and e-commerce technology as a first wave of transformation in the fashion business world. Further to this, more possibilities of retail are now in action such as, virtual reality technology. VR allows the customers to browse through variety of products or items and make buying decisions with a help of a click. These purchases have sometimes or many at times been proven as a wrong buy for the customer where the brands have also suffered the backlash from their customers who received their items but were not satisfied. Therefore, new VR platforms have risen

to change the outlook by merging the physical world with web world of retail industry. For example, try-on avatars are becoming a big hit in the fashion world. Apps such as *DressingRoom* is used by Gap. The brand wants to commit to make it easy and effortless for the customers to look great and on trend, while delivering products that fit them better, and help them look better and confident. These apps provide customized measurements and styling that would suit the customers before the outfits are purchased. These platforms also help the retailers to gain insights of the brand. [17]

IV. MODEL FOR MOBILE APPLICATION

Our paper introduces a model of mobile application, which is based on Geo-fencing technique Fig.4. So if a user is near by the store he/she will get the notification, about the store. Apart from this users who are registered with the store will also get the notification about the store, sent by mobile application. This application will be more effective when a user is in store or near by the store.

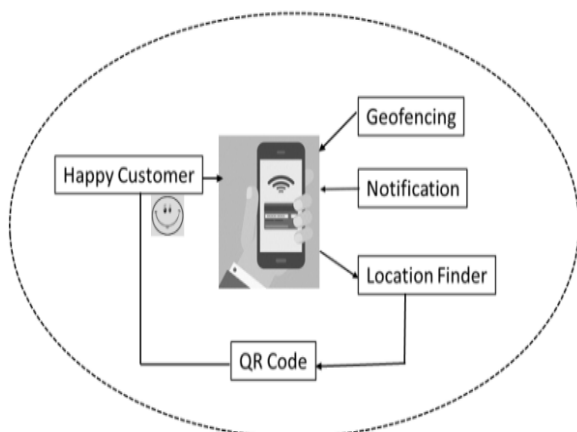


Fig. 4. Model of Mobile Application

Quick Response (QR) code: QR codes are two dimensional matrix based structure (Fig.5). This matrix code is machine-readable that consists of black and white squares. Data which can be stored that can be in the form on images, vedio, text URL (Uniform Resource Locator), contact information, link and much more. [18] It can store up to 7000 digits. QR codes were created by Denso Wave in 1994, which a subsidiary of Toyota group. Use of QR code is free now. QR codes can be generated now in free of cost. QR codes are getting very popular, because today QR code reader can also be downloaded in mobile phone and any smart phone can work like a QR code scanner.



Fig. 5. Sample of QR code

In general QR codes are structure with few elements. Following table explains the same.

TABLE-2 ELEMENTS OF QR CODE

Positioning Pattern	Indicates the way in which the all Code is printed.
Alignment Pattern	If QR code is large then entire data can be aligned with the help of this pattern.
Timing pattern	Time taken by scanner to evaluate about size of data.
Version information	Determines QR code version being used.
Format information	These patterns contain error tolerance information for easy scan of code.
Error Patterns	The actual data is in these patterns.
Quiet zone	This is important as this separates QR code from surroundings.

Geo-fencing: Geo-fencing is a resource of technology that activates the activity of a device when entered in a set location. This helps the GPS (global positioning system) or RFID (Radio frequency identification) to define the boundaries of geographical map. It also enables to set up Trigger (Triggers are used to preserve data authenticity by detecting on or changing data in a congruous manner) so when a device enters or exits the defined boundaries a signal may emerge. Geo-fencing many a times also is incorporated in google earth and helps to identify the boundaries of a geographical area (a satellite view). Another app is to define boundaries by latitude and longitude through web- based maps. [19]

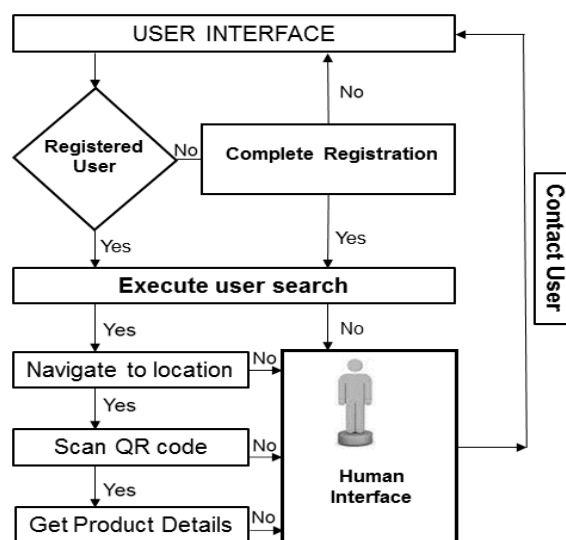


Fig. 6. Process Layout of Mobile Application in store

Our suggested model for mobile application works like following: (Fig.6)

1. Checks for registered user.
2. Immediately let him/her knows about the latest update about store based on previous latest trend or user previous interest.
3. Application provides an option of location finder for an item in store where user can visit directly this will save the user time. (As many a time it is difficult to find a particular product in a store itself.)
4. At the location, based on category, QR codes are placed, which can be scanned by user by same mobile

application and can get the details about product immediately in his/her mobile.

5. In case user is not able to find exactly for what user is looking for, mobile application also provides an option of photo upload, if user is carrying for the item for which user is looking for.
6. Based on this upload, application will guide you for the related item in store, in case not available, application will guide you for best available match with the upload along with a notification to sales team so that someone can help you for this search/upload.

User may request for the search, which may be one of the following (Fig.7)

Received notification Search: User may receive many notifications, from store, based on geo-fencing location. In this case, as this notification sent by store, will have direct availability in database.

User customized Search: User may look for a new product, which can be requested in a format with the help of mobile application. In this case there may be a probability that product is available or not.

Image Search: Mobile app has an option of image upload in case user wants to upload an image for which user is looking for results. An image search will help user to look for exactly user is looking for which user is not able to complete with customized search option.

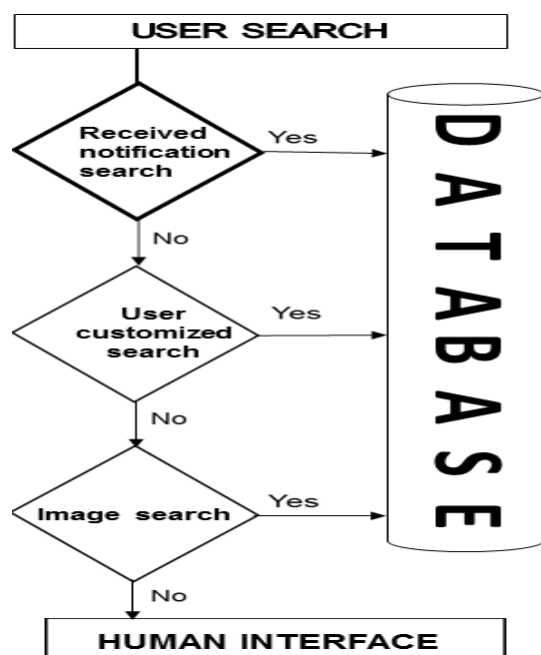


Fig. 7. User search (Image/Customization/Notification)

V. CONCLUSION

Our suggested model of mobile application will help user and vendor both (Fig.8). Benefits to both will help to promote sustainable fashion.

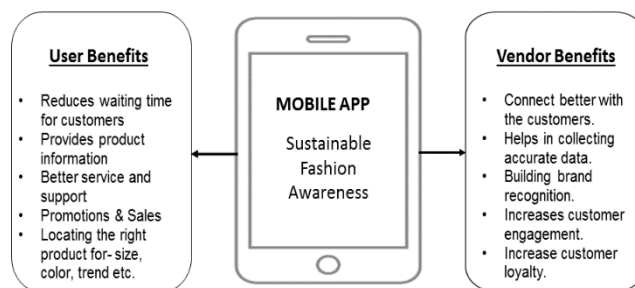


Fig. 8. User and Vendors benefits

As user will save time to locate the product and in case, user is not able to locate, store will get notification for the same and someone from store will come to user for immediate help. This model is better than salesperson assistance model as here user feels free as sometime user is not comfortable with salesperson assistance. By this application user will be updated with latest products which are trending. At the very same time this model is more useful for vendor, as vendor can be updated about user search and can estimate about popular product, the product which are searched but not sold, the product which are scanned but still not sold, type of image search done by user. This all data will give a deep insight about users liking and disliking, which will help vendor to offer product according to user preferences. This application will also help the day and time when the user is searching about product or passing by from store location. As mobile application will be available continuously with user to other application like image search and to search about any other product will also help vendor to understand more about user preferences.

REFERENCES

- [1] Sanem Odabaş, a design method on Wearable art, Anadolu Universiy, November, 2015, pg-2.
- [2] Book on Sustainable Fashion Jastram, S. M. (Ed), Schneider, A. (Ed) (2018) pg, 3-8
- [3] Fast fashion: response to changes in the fashion industryVertica Bhardwaj* and Ann FairhurstRetail and Consumer Sciences, The University of Tennessee,Knoxville, USA,February,2010.
- [4] Fast Fashion, Sustainability, and the Ethical Appeal of Luxury Brands Annamma Joy Annamma Joy, University of British Columbia, John F. Sherry Jr John F. Sherry, Jr, University of Notre Dame, USA., Alladi Venkatesh Alladi Venkatesh, University of California, Irvine, USA., Jeff Wang Jeff Wang, City University of Hong Kong. & Ricky Chan Ricky Chan, Hong Kong Polytechnic University. Pages 273-295 | Published online: 21 Apr 2015.
- [5] Environmental sustainability in fashion supply chains: An exploratory case based research Authors,Federico Caniato, Maria Caridi, Luca Crippa, Antonella oretto Moretto, International Journal of Production Economics Volume 135, Issue 2, February 2012, Pg.1.
- [6] Environmental sustainability in fashion supply chains: An exploratory case based research Authors,Federico Caniato, Maria Caridi, Luca Crippa, Antonella oretto Moretto, International Journal of Production Economics Volume 135, Issue 2, February 2012,pg 2-4.
- [7] Environmental Impacts in the Fashion Industry, March 2012,DOI: • 10.9774/GLEAF.4700.2012.sp.00004, Anika KozlowskiAnika Kozlowski, Michal Bardecki, Cory Searcy.
- [8] Sustainability Excellence, "The leading provider of sustainability reporting services in the Arab region " Available at: <https://sustainabilityexcellence.com/portfolio/sustainability-reporting/> Accessed on: 10.01.2019
- [9] Ethical fashion: myth or future trend?Author(s):Catrin Joergens (Heusenstamm,Germany) 2013.
- [10] Grundmeier AM November 05, 2017 Why sustainability within the fashion market needs education. J Fashion Technol Textile Eng S3: 007

- [11] Forbes, "Three Ethical Retailers For Your Next Sustainable Fashion Purchase" Available at: <https://www.forbes.com/sites/annaschaverien/2018/11/26/ethical-sustainable-fashion-retailers/#60ab7610c845> accessed on 10.01.2019
- [12] The Influence of Social Media on E-commerce: Fast Fashion Multinational Companies Mariama Manneh – 9109271008, 2017-01, Pg,16-23.
- [13] AI and IoT, November 2018 DOI: 10.13140/RG.2.2.22976.58881 121 author: Muhammad AL-Qurishi Pg,36-42.
- [14] Wearable X, "Yoga Pants" Available at: <https://www.wearablex.com/> accessed on 10.01.2019
- [15] AI and IoT, November 2018 DOI: 10.13140/RG.2.2.22976.58881 121 author: Muhammad AL-Qurishi ,Pg-5.
- [16] M-Commerce Services, Ljupco Antovski, Marjan Gusev Institute of Informatics, Faculty of Natural Sciences and Mathematics Ss. Cyril and Methodius University, 1000 Skopje, FYRO Macedonia, Pg 1-3
- [17] Understanding Virtual Reality in Marketing: Nature, Implications and Potential Stuart J. Barnes Department of Management King's College London, Understanding Virtual Reality in Marketing: Nature, Implications and Potential. Pg,6-13.
- [18] International Research Journal of Engineering and Technology (IRJET), Volume: 03 Issue: 11 | Nov -2016, Page 1095,1096 Geofencing Infrastructure: Location Based Service,Sachin W. Rahate, Dr. M.Z. Shaikh,Computer Engineering Dept.Bharti Vidyapeeth College of Engineering, Navi Mumbai.
- [19] International standard ISO/IEC 18004, "Information technology Automatic identification and data capture techniques Bar code symbology QR Code", Reference number - ISO/IEC 18004:2000(E), First edition 2000-06- 15.