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Machine learning based e-commerce application using progressive web apps for online shopping of seasonal fruits

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***Abstract*---**The key objective of this work is to apply machine learning technique to implement an e-commerce application named eOrchard, a virtual store for online shopping of seasonal fruits. The application is developed using open cart framework, angular and uses the progressive web application development features. Now a days it is very difficult to locate and buy the seasonal fruits around us. The proposed web app will provide information about all kinds of seasonal fruits and facilitates doorstep delivery within a day for locations within the city limits and for location outside the city, delivery can be made within 2 days. Here, the details of all kinds of seasonal fruits are collected along with the geo location tags and stored in the cloud to provide easy access to everyone. Users can order by searching the fruit name or by clicking the city name to know the seasonal fruit that is famous in the selected city. The application provides 24x7 customer support and a step by step tracking system that provide continuous update for the users about the ordered products. Apart from this customized notifications and alerts to the users based on their previous search and purchase history using machine learning is provided to simplify the purchase process.

***Keywords*---**progressive web apps, opencart, geolocation, machine learning, seasonal fruits.

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Introduction

Online e-commerce websites are most popular all over the world. Eventually progressive web applications became the choice of many recent web site developers as they provide extremely fast access like native applications as well as reliability and high quality. The proposed work makes use of this feature to provide a rich and smooth experience to the customers to purchase seasonal fruits online. This system brings in a bunch of benefits from various points of view. This online application enables the end-users to register to the system online and helps them to identify the fruit items of their choice. The machine learning based notification and alert system will suggest and assist the users to order the fruits of their interest. Also, the payment can be made either in online mode or at the time of delivery depending upon the customer's choice and convenience.

Currently most of the organizations are migrating their existing web applications to Progressive Web Application (PWA). PWA can also be called as hybrid applications are they can also be accessed in mobiles. The PWA resembles native applications with high performance across multiple devices without any additional installation. Additionally the improved security and wide range of features and less development cost are the motivation for us to develop the application using PWA. Both the Health experts and doctors says that eating seasonal fruits is good for our health . It have higher nutritional value because they are fresher and consumed closer to the harvesting period. Now a days it is very difficult to get the seasonal fruits around us. For example if a person likes to have salem mangoes but if he is in some other place other than salem. It is difficult to go and buy the mangoes, instead our application can help such users to get all kinds of seasonal fruits from staying at their home town. We are storing the details of all kinds of quality seasonal fruits, users can order by searching the fruit name or by clicking the city name user will be getting the details of seasonal fruits famous for the selected city. Fruit vendors are carefully decided and we ensure that the fruits are of good quality and cultivated using organic farming practices and the rate is at par with the regular market rates. Our motto is to provide fresh and healthy fruits at a reasonable cost to the users using this application.

Selling all kind of fruits with the help of online shopping is made possible in our application. By using this application user can purchase fruits from anywhere in the world through internet. Once user logs in, our application will show the home page to the users. From that panel it displays the list of available products to the users. After selecting a product it will be directed to the cart panel where the user can add extra quantity of selected product. By clicking checkout button it will direct the user to perform the payment process. Online e-commerce website most popular in all over the world. The proposed application can help customer to buy the various types of fruits including seasonal fruits. This system has a bunch of benefits from various points of view. This online application enables the end-users to register to the system online, select the fruit items of their choice from the city wise list, and order fruit online. Also, the payment can be made through online mode or at the time of home delivery depending upon the customer's choice and convenience.

Once the user completes the payment, there is an option to view the status of the product in Map View. With the help of longitude and latitude (geolocation with leaflets plugins) can display the location of the product. So that the user can know more information about the product, especially in which place the product has been packed or to see the status of the product in every movement. Also, giving 24*7 customer support and mainly we are maintaining step by step tracking system for the products. Including the geographical identification metadata such as latitude and longitude coordinates, altitude, place name, etc. to various media such as photographs, video, websites helps the users to identify the availability of the product in the nearest location, to reduce the freight charges.

This application has the advantage of providing personalized notification based on the user search and purchase history. Based on the products that were purchased previously , also the products searched by the user along with the meta data information like the time, date, minutes and other useful details a recommendation system based on machine learning is used for sending exact notification as per the taste of the users. The recommendation system will send notification through email or message alerts the users wherever the preferred fruits are uploaded by the vendor. Hence, the proposed system will provide a glistening experience to the users with the help of recent tools and techniques. The novelty of adding geo tags to the products and the collaborative filtering based recommender systems makes this application different and better that the other applications of this kind.

Materials and Methods

There are numerous articles and books available to illustrate the benefits of eating seasonal fruits. The review paper by Leelarungrayub et. al. (2019), gives various potential health benefits of Thai seasonal fruits. The author proved that the population in aging stage has been increased around the world. Eating the seasonal fruits can help them to lead a healthy and disease free life. A similar survey presented by Zhang X & Zhang H (2016) talks about the changing food practice of China towards fresh fruits. In China, a country with larger population has adopted the habit to eat fresh fruits and vegetables; here the authors also bring out the statistics, showing the health benefits of eating the fresh food.

Prashanth & Vaidya S (2018), explains the improvement of online shopping throughout the globe. There is a huge requirement in the market for selling any product online to increase the sales and profit. However there should be equal amount of focus need to be given for selecting proper tools and techniques. Progressive web application can be considered for developing new applications. When compared with standard web applications the PWA is more reliable, fast and engaging. The facility for enabling notifications even if the browser isn't open is very useful. At the top of everything, there is no lagging in time even if the bandwidth is very low, because the service worker plays a huge role when working in offline mode.

The integration of machine Learning plays a great role on web development especially in PWA. Recommendation system using machine learning deals with

the use of cookies which holds the information about the last product visited with two parameters such as the user's id number and viewed items id number (Walker Jeff & Chapra Steven, 2014). Based on the collaborative filtering technique the application recommends products based on user's interest and browsing history. For example, users who buys apple will also buy a mangoes. If some user is interested in buying mangos then they will be recommended to buy apples also (Weber et. al, 2019). The overall architecture of the proposed work is presented in Figure 1.

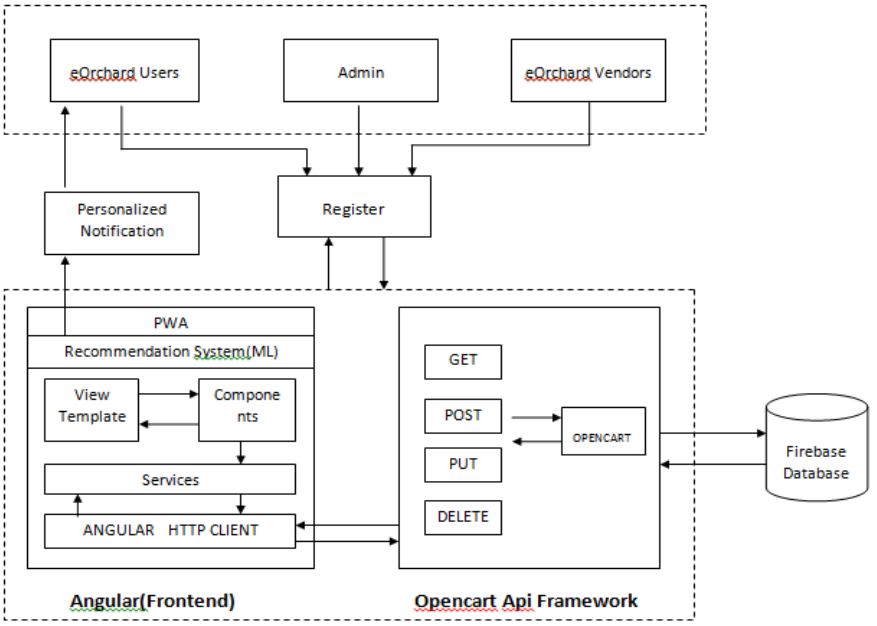

Figure 1. Overall Architecture of the proposed work

The web application development method is carried out in 2 phases which incorporates backend and frontend development (Gellersen, H & Gaedke, M, 1999). The application is developed using VS Code (Visual Studio Code) is computer code used for writing and redaction of the code at the developing environment. It supports all the most operating systems like windows, macOS, linux. It is well-liked among the developers, thanks to its options that embody the support for debugging, syntax highlight, snippets, code refactoring and intelligent code completion.

Backend development

Backend development refers to the application's server side. It usually consists of 3 elements which incorporates a server, an application associated with the information. The backend code can communicate with the database and provides information to the browser. The backend language used for developing is PHP. For the application developed for html, css, javascript, php is used with a specific Opencartframework. The application runs within the server that is receiving the requests from client. The data is managed by the database, MySQL database is used for the project. Fetching of the data is done using the Open cart API with the

help of HttpClientModule. The HttpClientModule is a service module provided by Angular that allows us to perform HTTP requests and to easily manipulate those requests and their responses.

Frontend development

Frontend development is based on client side development. It is basically the user manages and user interface. The frontend tools are HTML, CSS, java script, bootstrap, jquery and angular. These facilities provide a better experience for the users. The HTML is used to create a web page. For a pleasing design, the CSS is used for the styling purpose with full featured options like bootstrap and linguistics UI (Ullah et.al, 2016]. The javascript has many main frameworks like angular react, view.js and JQuery. The most recently widespread framework is that the angular 10 that is used within the developed application. Angular program line interface makes the start of associate Angular project quite simple. Angular interface consists of commands that facilitate the developers to develop and start on their project in no time. The installation ought to be done globally else it'll get downloaded within the current directory. Usage of Angular interface for developing angular applications is suggested since it saves the time as installation and configuration of all required dependencies and wiring everything up isn't needed just in case of interface (Sayali, S.T., Abhishek, J. 2018).

Frontend and backend communication

The Opencart API permits to integrate shopping cart practicality into their own websites and systems, still as manage the checkout method. The API includes strategies for making, reading, updating, and deleting store information. The HttpClientModule is a service module provided by Angular that permits to perform protocol (HTTP) requests and simply manipulate those requests and their responses.

Progressive web apps

PWA may used as a mobile development approach that seeks to overcome the challenges or weaknesses of earlier approaches like native, ancient internet etc. Adopting the approach of PWA produces special reasonably internet apps which requires no installation before exploitation and is served from a remote server via a secured machine-readable text transfer protocol in contrast to regular mobile internet apps. PWA users can have the advantage of employing a high level mobile application with a full screen mode using the installation method in their own device (Akter, S., Wamba, S.F. 2016). The PWA relies on the ideas of one application for all platforms rather like the hybrid approach (Dhanashri et. al, 2020). The PWA is Quick, generally rendering content on user’s device in just seconds. Stable, even on weak quality Internet connections or on weaker devices and can even work offline. PWA combines the options of each native and traditional internet application that gains the preference over all different architectures. The foremost necessary feature of PWA is that, it can be simply be installed from the home screen with one click. Whereas, the native applications includes many procedures for installing it in the device (Akter, S. & Wamba, S.F. 2016).

Service Worker file is the foundation of a PWA. Service Worker is primarily a command for giving appear message and conjointly taking care of organizational traffic. This case, we will build use of the service worker that creates an enormous distinction in application once not connected to the network. In the browser cache, It will store the info and when the shopper is visiting the application, the service worker can stack the knowledge within the browsing atmosphere since it's antecedent cached Weinberger. The service worker must be registered within the index.js file and accordingly the employee.js file containing the applying cache info must be extra. The manifest should inform details for websites put in on the home screen of a tool, providing users with faster access and a richer expertise. A congregation of internet technologies known as progressive web apps includes internet app manifests as its half through that websites which will be put in to a device's home screen without play store (Sayali & Abhishek, 2018).

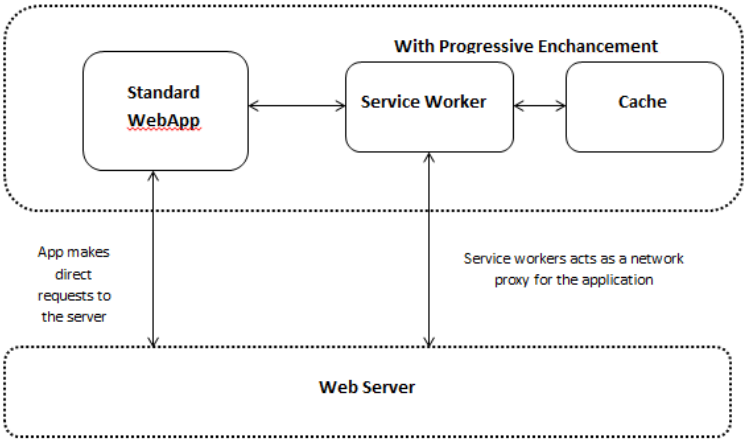

Figure 1. Standard WebApp (PWA)

Geo tagging and tracking

The proposed system include geo tag into an all picture because of that the need not have to worry about the quality and cost of the product. Pavlou (2003) proved that trust has an impact on intention by creating a positive attitude. Once the user completes the payment, there is an option (button near the product) to view the status of the product in MapView. With the help of longitude and latitude(geolocation with leaflets plugins) can display the location of the product. So that the user can know more information about the product, especially in which place the product is packed and can also see the status of the product in every movement. Also the 24*7 customer support will greatly benefit the users.

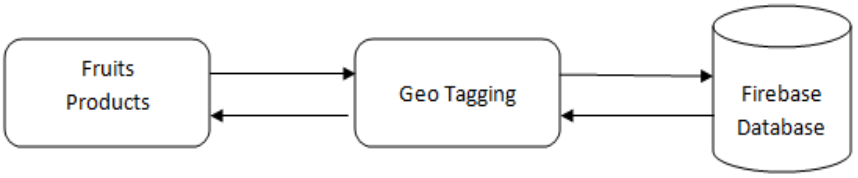

Figure 2. Geo Tagging of fruits

Recommendation systems

A recommendation system is a type of information filtering system that attempts to forecast how a user would rate or prefer an item. In layman's terms, it's an algorithm that proposes goods to people that are relevant to them. The benefits of taking balanced diet to reduce the mental and physical stress of all people irrespective of their gender, religion, language, geography, caste, and class was studied and presented by (Radha, 2019). The same author (Radha, 2018) proposed a BPNN model to predict the strength of chakras and auras without using the costly equipment. Talasila et. al. (2014) have proposed several recommendations of generate resistance to insulin by taking healthy fruits and vegetables. Ibrahimagić et. al. (2016), have figured out the Prevalence of antibiotic resistance of ESBL and measures to reduce them.

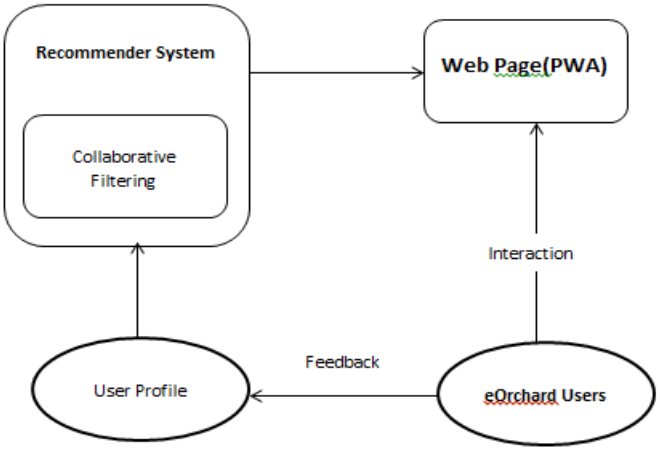

Figure 4. Recommendation System for eOrchard

While machine learning plays a great role in web application, it give more features for better user experience. The intent is to provide more useful interaction with the client. The application will recommended the users and suggest the items that are most relevant to him or her whether they try to buy or watch the fruits online. The recommendation system usually operates in the background that is looking at user behavior and suggesting items that user most liked by the user. The collaborative filtering approach relies on the behavior and the information of other users who have watched or bought items earlier. Location recommendation system based on KNN algorithm is found to be more efficient. Recommendation is based on the rating given by the users for a particular product. As shown in Table 1, the details like product_id, user_id and rating are collected from every user for every product.

Table 1
Data Collected from the application

Sl. No.	Product_id	User_id	Rating
0	1	412	5
1	1	418	3

2	1	218	4
3	1	319	4
4	1	189	5

Personalized notification

Personalized notification will be sent to the users based on their search and purchase history. The search history of the users will be collected using the web crawling method. Machine learning is applied to the collected details. After applying the collaborative filtering technique, a suitable fruit will be recommended to the users. The search and purchase history of a particular user is shown in Figure 6. Using that figure it is easy to make recommendation to the users.

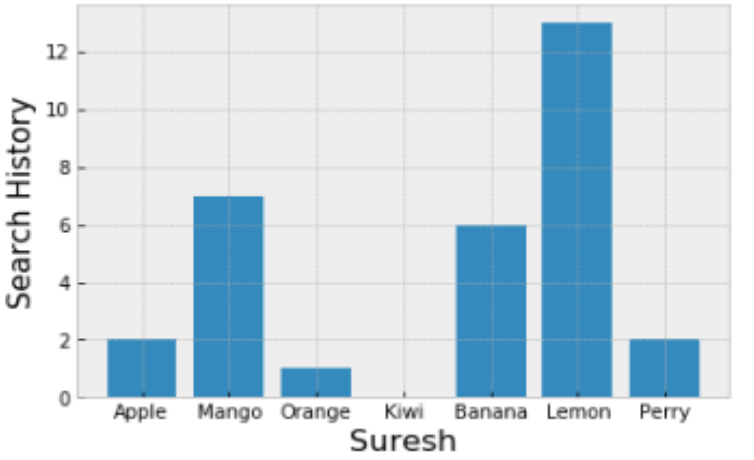

Figure 6. Search and purchase history of a user

Results and Discussions

The application is adopts PWA and implemented using angular as the front end and opencart API as the frame work. The data is stored in firebase cloud for easy storage and retrieval.

Frontend design

The application is created using angular 10. The main intent of this application is to work on advanced technology and provide easiness and comfort for the customers to handle it. By default it provides more attraction and user-friendliness. The user first has to signup in the page by using his/her credentials. Each user will have his own session token which has a expiry time. The signup page is created using conditional rendering. Once signed in successfully, using the credentials the user will be navigated to the home page wherein all the products available for sale displayed in an orderly fashion. A sample home screen is shown in Figure 7 and Figure 8.

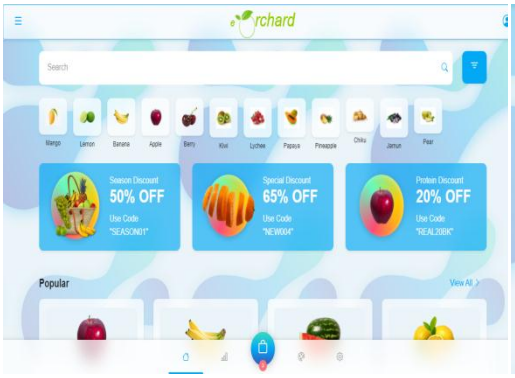

Figure 7. Home Screen

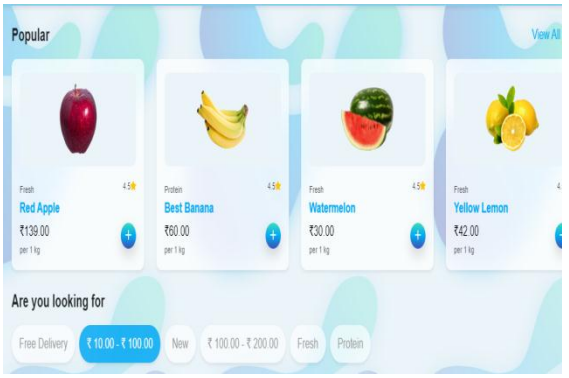

Figure 8. Most selling items

Adding items to the cart

The user will have the option to add any number of selected items to the cart and also to remove them from the cart. Individual cart is created for eveary purchase which has all the necessary methods which can also be modified later according to the user's need (Mahdi & Kadhim, 2019).

Payment gateway and tracking

Once the item has been added to the cart, the total amount will be displayed to the user and also with the help of Razor payment gateway users can make the payment in this E-Commerce application. It serves as the best payment system which provides a smooth payment. As the Razorpayto is integrated into server side of the application, the angular will send the order details to backend server through the API that provides so many payment methods for the users. Using map view the users can track their product time to time. A sample product status using map view is shown in Figure 9.

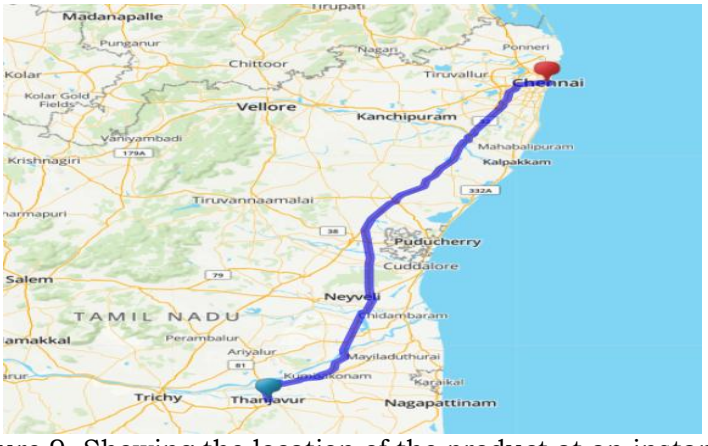

Figure 9. Showing the location of the product at an instance

Comparison

The advantages of using PWA for developing this application is justified by comparing the performance of the application with and without PWA and presented in Figure 9 and Figure 10 respectively.

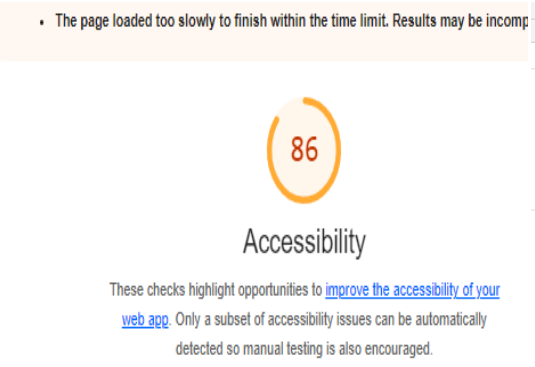

Figure 10. Performance of the application without PWA

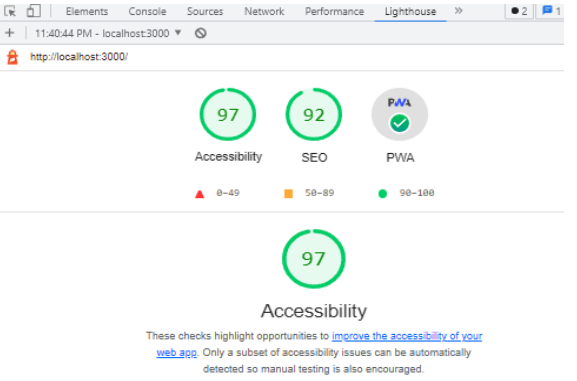

Figure 11. Performance of the application using PWA

From figures 10 and 11 it is clear that using PWA for application development renders the application with quicker that the native applications. The performance has improved more that 10% when compared to the existing solutions.

Conclusion

This paper brings out the benefits of PWA and machine learning to design and develop an online fruits store named eOrchard especially to buy and sell seasonal fruits. The details of available seasonal fruits are collected along with the geo location tags by the fruit vendors and uploaded to the fire base cloud with help of a mobile application. The features of PWA such as responsive, connectivity, independent, installable, safe and gives offline access during low bandwidth connectivity with the help of the service workers makes this application superior to other applications of this kind. Apart from this, the application provides 24x7 customer support and a step by step tracking system to provide continuous updates about the ordered items. The application also has a notification module that sends customized notifications and alerts to the users based on their previous search and purchase history using machine learning. This unique feature helps the users to buy the items

References

Adetunji, O., & Chigozirim, A. & Nzechukwu, O.(2020). Edging Out the Pitfalls of Traditional Mobile Development. American Scientific Research Journal for Engineering, Technology, and Sciences. 68, 85-99.

Akter, S., Wamba, S.F. (2016). Big data analytics in Ecommerce: a systematic review and agenda for future research. Electron Markets. Vol. 26, pp. 173–194.

Dhanashri, J., Priyanka,P.,Vaishnavi, U and Sanjay S (2020). Progressive Web Application For Salons Using Artificial Intelligence, IEJRD, International Multidisciplinary Journal, Vol. 5, pp.8-14.

Gellersen, H., & Gaedke, M. (1999). ObjectOriented Web Application Development.Internet Computing, IEEE. Vol. 3, pp. 60 - 68. https://dor.org/10.1109/4236.747323.

Ibrahimagić, A., Idrizović, E., Divjan, E., & Klimenta, B. (2016). Prevalence and antimicrobial resistance of beta-lactamase-producing Gram-negative isolates from outpatient clinical and environmental samples in the Zenica-Doboj Canton, Bosnia and Herzegovina. Journal of Health Sciences, 6(2), 94–99. https://doi.org/10.17532/jhsci.2016.337

Irakrit, L. (2019) Potential Health Benefits of Thai Seasonal Fruits; Sapodilla and Star Fruit for Elderly People. Am JBiomed Sci& Res. 2019 – Vol. 5 No. 1. AJBSR.MS.ID.000873. https://dor.org/10.34297.

Kaavya Shankar, R., Vairamuthu, S. (2021). Interactive E-Commerce Progressive Web Application Using Web Framework and Machine Learning Technologies, International Journal of Innovative Research in Science Engineering and Technology (IJIRSET). Vol. 8, pp. 106-117.

Mahdi A. H & Kadhim, Q. (2019). Design and Implementation of E-Commerce Website for Shopping.

Pavlou, P.A. (2003). Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model.International Journal of Electronic Commerce, Vol. 7 No. 3, pp. 101- 34.

Radha P (2018). Intelligent models for predicting and classifying the bio energy of human body, international journal of current engineering and scientific research (IJCESR), Vol. 5 No. 3, 44-54.

Radha P (2019). Correlating Health-Oriented Human Traditions with Basic Science and Automating Health-Related Processes Using Modern Science, International Journal on Human Arenas. Vol. 1 No. 1, 1-20.

Saibaba, G., & Vaidya, S. (2018). Developing anUserfriendly Online Shopping Web-Site.Indonesian Journal of Electrical Engineering andComputer Science. Vol. 12, pp. 1126-1131.

Sayali, S.T., Abhishek, J. (2018). Impact of progressive web apps on web app development , International Journal of Innovative Research in Science Engineering and Technology IJRSET. Vol. 7 No. 9.

Talasila, E., Bavirisetti, H., Chimakurthy, J., & Candasamy, M. (2014). Effect of Costus igneus: The insulin plant, on prediabetes and diabetes in neonatal streptozotocin rats. Journal of Health Sciences, 4(3), 162–168. https://doi.org/10.17532/jhsci.2014.163

Ullah, E., Alauddin, T., & Zaman, H.U. (2016). Developing an E-commerce website. International Conference on Microelectronics, Computing and Communications (MicroCom), Durgapur, India, pp. 1-4. https://doi.org 10.1109/MicroCom.2016.7522526.

Walker, J & Chapra, S. (2014). A client-sideweb application for interactive environmental simulation modeling. Environmental Modelling & Software. Vol. 55, pp. 49–60. https://dor.org/10.1016/j.envsoft.2014.01.023.

Weber, F & Schütte, R. (2019). A DomainOriented Analysis of the Impact of MachineLearning—The Case of Retailing. Big Data andCognitive Computing. Vol 3 No. 11. https://dor.org/10.3390/bdcc3010011.

Weinberger, J, Saxena, P, Akhawe, D, Finifter, M, Shin, E & Song, D (2011). A Systematic Analysis of XSS Sanitization in Web Application Frameworks.150-171. https://dor.org/10.1007/978-3-642-23822-2_9.

Xuewen Zhang, Haifang Zhang, Fresh Fruits and Vegetables “Last Mile”Home Delivery in China Current Situation Research”,American Journal of Industrial and Business Management,2016,6,846-853.