

E-COMMERCE WEB APPLICATION FOR AGRICULTURAL DEVELOPMENT IN SRI LANKA

RL Jayakody¹, DMR Kulasekara, and ADAI Gunasekara

Faculty of Computing, General Sir John Kotelawala Defence University Rathmalana, Sri Lanka

¹ravinajayakody@gmail.com

Abstract- This research has been conducted to develop an e-commerce web application based on agriculture, which can be used by cultivators, and consumers across the nation. This application will also include the capability of adjusting and functioning on mobile phones.

This e-commerce application acts as a mediating platform between the cultivators and the consumers making it possible for both parties to directly interact with each other without the aid of a third-party, who in Sri Lankan scenario gains the highest profit by getting the agricultural products from the cultivator to the consumer. Due to this web application, users can also be aware regarding the agricultural products in other geographical locations as well.

This e-commerce website has a great possibility in increasing profit for the cultivators in the rural areas. This web application could also be predicted to drastically lower the consumer end-price of agricultural goods which can encourage people to consume more healthy food. On the other hand, this could be a great incentive (morally and monetary) for the cultivators to cultivate and promote their geographical and agricultural products. Therefore, the country can develop more in the path of agriculture.

Keywords- e-commerce, web application, agriculture

I. INTRODUCTION

Currently most of the cultivators in rural areas are facing difficulties in selling their agricultural products to the consumers. This problem has arisen due to many reasons.

One such reason is due to the third-party that is being involved in the process taken place from the cultivator to the end-consumer, since this is a long process and therefore it is very time consuming. For example, when a consumer requests for certain agricultural products from a third-party, the third-party will then have to contact the cultivators to receive the expected products, hence having a third-party consumes time than the consumer contacting the cultivator directly. Involving a third-party extremely increases the end-prices of the products according to the Sri Lankan scenario. This can in turn lead to less consumer consumption of the desired products from cultivators and consume other alternatives. As a result, it will occur in cultivators' mental and lifestyle degradation. Even though there are a vast variety of agricultural products that is being produced, they are not exposed to places in Sri Lanka other than the geographical regions they are produced in, thus lack of awareness among consumers results in wastage of agricultural products.

This agriculture aiding e-commerce application using the web platform is developed as a solution for the above-mentioned problem. All the users should be registered members of this application in order to access the web application. It is possible for the users to display the text in the interface in either Sinhala or English. They can also upload images regarding their products. Once the image is uploaded the application has the capability of identifying the content of the image to recognise which product type it belongs to. The location of the cultivator can be either uploaded manually or automatically detected via the application. The input public information about the cultivators will be displayed for the consumers. The consumers can select or search for their expected agricultural products. A list of cultivators available with the desired product will be displayed. Along with those

information, the locations of those cultivator will be displayed to the consumer. The nearest consumer with the available product will displayed at the top of the list. The consumer can place an order to the cultivator regarding the need of a certain product(s). When an order is placed the cultivator will get notified. The delivery of the agricultural products will then be in process after it is agreed either to pay via PayHere or cash on delivery.

II. RELATED WORKS

A. Impact on Market and Retailers

This research focuses on the cultivators in rural areas, agricultural economy of Sri Lanka and the preferences to propose the best-suitable e-commerce web application for the user island wide. It could be seen that this could be achieved at a software level. Implementing an e-commerce web application which is successful encompasses the knowledge and understanding of the limitations and diminishing the negative impact whilst simultaneously increasing the benefits of e-commerce businesses. Economists have made speculations that the price competition can be strengthened by e-commerce as it escalates the capability for the consumers to gain information about products and its prices. (Shahriari et al., 2015) Transforming of social and economic organisations by the vast technological advances which as a result brings millions of people in the entire world together. (Ignacio et al., 2017) Therefore, in this modern and more competitive environment with all the technological advances, medium-sized and also small businesses ought to be prepared and cognizant of the globalisation which is being experienced and cooperate with the electronic environment to acquire competitive advantages. (Ignacio et al., 2017) Electronic commerce affects the supply and demand of goods and service in different businesses, the structure of the business and competition in several sectors. The spread of e-commerce will continue in reducing the costs of transaction and also the costs of production and facilitate integration of new companies into the markets and escalation of competition will be anticipated in the short run. Thus, lower prices, increase the levels of quality and create novel and more products in a wide-range consequently increasing the growth of economy and welfare. (Ignacio et al., 2017)

B. Language Literacy and Computer Literacy

For e-commerce, computer literacy data can provide immeasurably to an understanding of the demand

and supply of skills in the global, knowledge-based on economy.

Table 1. The computer literacy rate by sector and province in Sri Lanka for the years 2016 & 2017 during its 1st 6 months.

Sector/Province	Computer literacy rate (%)	
	2016	2017
Sri Lanka	27.5	28.3
Sector		
Urban	38.5	41.1
Rural	26.1	26.5
Estate	9.9	9.5
Province		
Western	38.5	38.6
Central	26.0	30.2
Southern	27.2	29.1
Northern	19.9	15.1
Eastern	13.4	13.7
North Western	27.3	26.3
North Central	21.6	20.9
Uva	18.5	15.5
Sabaragamuwa	23.4	26.8

According to the "Computer Literacy Statistics – 2017 (First six months), from the Department of Census and Statistics, Sri Lanka" the results for computer literacy in various age categories, sectors and provinces, language literacy fields, and as well as in various occupational groups are shown in the tables as displayed above.

A person in the age limits within 5 to 69 is considered as a literate in the field of computing if he/she is capable of using a computer on his/her own. For example, if a child who is 5 years old has the capability of playing a computer game then, he/she can be considered to be a literate in the field of computing.

In the first half of 2017 for Sri Lanka, the general rate for Computer Literacy is reported as 28.3%. The above survey results demonstrate an increase of 0.8 percentage points from the first half of 2016 to the first half of 2017. The highest literacy rate in computing is shown by the Urban sector with a percentage of 41.1 amongst the residential sectors, whilst the rate of computer literacy for the Rural and Estate Sectors are shown as 26.5% and 9.5% respectively. When taking the provinces into consideration, computer literacy with the highest level is

stated from the Western province with a percentage of 38.6 whilst the computer literacy with the lowest percentage is reported from the Eastern province with a percentage of 13.7. (Computer Literacy Statistics, 2017)

Table 2. Computer literacy rate amongst computer aware employed population within the age limits between 15 to 69 years by Occupation during the first 6 months of the year 2016

Occupation group	Computer literacy (%)
Sri Lanka	64.8
Managers, Senior Officials and Legislators	76.1
Professionals	90.3
Technicians and Associate Professionals	89.3
Clerks and Clerical support workers	91.5
Services and Sales workers	60.1
Skilled Agricultural, Forestry and Fishery workers	22.7
Craft and Related Trades workers	43.4
Plant and Machine operators and Assemblers	53.3
Elementary occupations	27.1
Armed Forces Occupations & unidentified occupations	86.6

The table displayed above has discovered that Skilled Agricultural workers as well have the least knowledge in the field of computer literacy, in Sri Lanka. (Computer Literacy Statistics, 2016)

Table 3. Computer literacy rate by Language literacy for the first 6 months in the year 2016

Language literacy	Computer literacy rate (%)
Sri Lanka	
By Language literacy (age 10 - 69)	
Sinhala	33.5
Tamil	26.2
English	72.5

The above shown table reveals that the computer literacy is higher among those who are also literates in the English language. According to the survey it is displayed that the English literates have a percentage of 72.5 in computer literacy than the Sinhala and Tamil literates who has their computer literacy as 33.5% and 26.5% respectively. (Computer Literacy Statistics, 2016)

C. Existing Websites

There are a numerous number of websites in the world. As we have researched and analysed throughout various

types of websites, I have come across many websites which are quite complicated to be used by people who are Non-English literates as well as non-computer literates. Certain websites which are currently implemented, such as European websites, Asian websites, Sri Lankan websites are taken into consideration and are listed below;

- i. Amazon
- ii. Royal Flora Holland
- iii. ikman

The interface of amazon.com and Royal Flora Holland seems user-friendly almost for any person who even has a moderate level of knowledge in the English Language. Whereas for non-English literates in rural areas, such interfaces appear to be complicated and hard to understand since language translation into Sinhala is not available in these above-mentioned sites.



Figure 1. Graphical User Interface of an e-commerce website
Source: amazon.com

The graphical user interfaces on ikman however gives the impression of complexity for cultivators in rural areas even though there is language translation to Sinhala as well.



Figure 2. Graphical User Interface of an e-commerce website
Source: ikman.lk

The cultivators in rural areas in Sri Lanka expect their work to be done with much ease with a minimum number of clicks in the website due to the lack of knowledge and skills they possess, else the website is found to be complicated and mystifying and will eventually be rejected by them by tending to not use such websites for their purpose. They also require their tasks to be done in a stepwise manner one after another, which gives them a clear idea of how the process may take place. Consequently, the consumers outside the geographical area will be unable to know about the availability of the products by the farmers in that specific location and will therefore result in wastage of food.

All the above-mentioned websites give the opportunity for the users to allow photos of the products to be uploaded, nonetheless, none of these websites has the capability of automatically identifying the type of product which has been uploaded and retrieving the necessary data regarding the product instead of allowing the user to enter all the details in to the system to post and display about their product. Absence of such availability in current websites have been overcome by our system by using existing technologies in order to create such a website which will only entail a minimum amount of inputs to the system and a maximised level of output to the user. Thus, permitting the possibility of achieving the expected work done with a limited number of clicks.

D. Location Identification

In today's world, due to the advances in technology to make it much more convenient to the user in every aspect there are several researches being taken place daily around the world. Researches are being done based on tracking the location of a person and showing the route to a person from source to destination. Using of these services will guide the user throughout the route also notify them about the nearby places in which there's availability of goods and services according to their preferences. (Indunil et al., 2017) Google APIs are used for better context data for navigation purpose which is considered by more than a few researches. (A. Kushwaha, V. Kushwaha., 2011) Using the APIs for location in the website it makes the possibility to provide the users with much more convenience during the search for food products.

E. Food Wastage

The wastage of food worldwide is about third of all food which is wasted each year. This further indicates that the

loss of food also means as the loss of nutrition which is occurring due to the worsening quality or degrade of nutritious crops. Food which are rich in nutrients such as fruits and vegetables have the rate of wastage which are higher than any other food product. Although there is only an inadequate amount of information about the loss in micronutrients in food value chains, an occurrence in the loss of Vitamin A from the loss and wastage of food has been assessed via studies. In view of the insufficient micronutrients globally, the loss of nutrients could have turn resulted in momentous impacts on the efforts that are taken to lower the amount of unseen hunger and undernutrition. ("Reducing food loss is key to end hunger and undernutrition by 2025 | IFPRI," n.d.)



Figure 3. Food Wastage
Source: ifpri.org

Food losses in developing countries such as Sri Lanka have substantial consequences regarding the income of cultivators in rural areas, who leads the cultivation of various food items and also them being the major percentage of the poor and undernourished populaces. The extent of the crops to be sold reduces when on-farm losses occur and will therefore lower the cultivator's income mainly, in rural areas. ("Reducing food loss is key to end hunger and undernutrition by 2025 | IFPRI," n.d.)

On April 29th, 2018, the Vesak full moon poya day, a pumpkin dansel was held by one of the farmers from Makulugaswewa in Galewela. It is also said by him, that he does not harvest any pumpkins as there are no market for them. (lakmali, n.d.) This could be the reason why the economy in Sri Lanka is descending as there is lack of support for the farmers in rural areas and that they are unable of selling their widely cultivated crops.



Figure 4. A pumpkin dansel held by a dissatisfied farmer
Source: srilankamirror.com

In order to improve the security of food, increase the amount of nutrition, and income to cultivators in rural areas it is vital to reduce the losses in food. Nevertheless, particularly in developing countries, the extent of food losses where exactly in the value chain they befall for different products and countries is however indistinct, hence designing of targeted policies and programs to reduce the loss of food is strenuous. (“Reducing food loss is key to end hunger and undernutrition by 2025 | IFPRI,” n.d.)

III. MATERIALS AND METHOD

During the stage of development of the e-commerce web application, HTML, PHP, CSS, JavaScript and MATLAB language are used as the required programming languages. The database used for this application is MySQL. The web application languages mentioned above use the software JetBrains PhpStorm, XAMPP, and MATLAB for the implementation of the website. Bootstrap is used as the front-end framework for the designing of the website interfaces. JetBrains PhpStorm software is used for the coding of the web application. MATLAB software is used for image processing using the MATLAB language. A web server is crucial to host the web application for which Amazon Web Services will be used. Google Maps and Geolocation APIs are used to track the location of the users. Google Translate API is used to translate the displayed language on the application either from English to Sinhala or vice versa.

This application is using a minimum number of requirements from the users, regardless of the fact if the user is a literate in the field of computing or not. The website is also using user-friendly interfaces, and the

language displayed will be as per the users’ preference since people in rural areas have a great tendency to have much of a lesser knowledge in any foreign language, such as English. Therefore, Sinhala or Tamil could be chosen in replacement. Both consumers and cultivators can register to this application as a common user and gain the capabilities of both buying and selling. This system has the capability of tracking the location of the cultivators and consumers, to provide them with best facilities in order to get the products transported to the consumer from the nearest cultivator possible. The location will be notified via geolocation. Image processing is used to recognise the products from the images uploaded by the user, to ease the use of this system to its users. This application is developed with the compatibility for both desktop applications and mobile applications such as smart phones.

The Figure 5 below shows the layered design architecture for the proposed e-commerce web application.



Figure 5. Design architecture of the proposed system

In order to develop an efficient and effective e-commerce web application, certain functions that must be fulfilled to manage all the processes in this application.

- Capability of providing secure authentication.
- Ability to input data by the users.
- Ability to store and maintain a database.
- Ability to manage the content in the website.
- Fast and accurate search function filtered according to the consumer’s location.
- Prioritizing the contents displayed in the items page according to the user preferences.

- Ability to provide promotions and discounts.
- Use of report generation mechanisms.
- The “Help” facility to be always available for the users.
- Integrating of Email marketing.
- Including a wish list in the application to enable users bookmark items which they might prefer to purchase in future.
- A checkout which is easy to use.
- Various methods of payment handling such as; Cash on Delivery and PayHere.
- Should be a mobile friendly website.

The Figure 6 below shows all the activities that are done by the administrator and the users (consumer and cultivator) in the proposed web application.

IV. DISCUSSION

In Sri Lanka, at various locations, though people don’t cultivate in massive quantities, they cultivate for a certain extent. These cultivators come across a huge problem since they are unable to sell their agricultural products to consumers in other areas in the nation. To solve this existing problem, this application allows all cultivators and consumers in all geographical locations in the entire nation to interact with each other. There are agricultural products that are unique to specific geographical areas, yet in which consumers in other areas have less knowledge on those unique products. Hence, consumers having less awareness also leads to wastage of products and cultivators quitting in producing them. To overcome this situation this web application allows every consumer to increase their awareness in all types of products displaying it via the web application. At most circumstances, there’s always a third-party involved in between the consumer and the cultivator. Most consumers buy their products through the third-party for high prices. The third-party earns the most profit in the process from the cultivator to the end-consumer. Involving a third-party expects consumers to purchase products for greater prices than they could be consumed for lower prices when directly purchasing from the cultivator. The third-party demanding a high price could be a reason possibly due to the cause of transportation expenses from the cultivator end to the third-party since the products may be transported from far

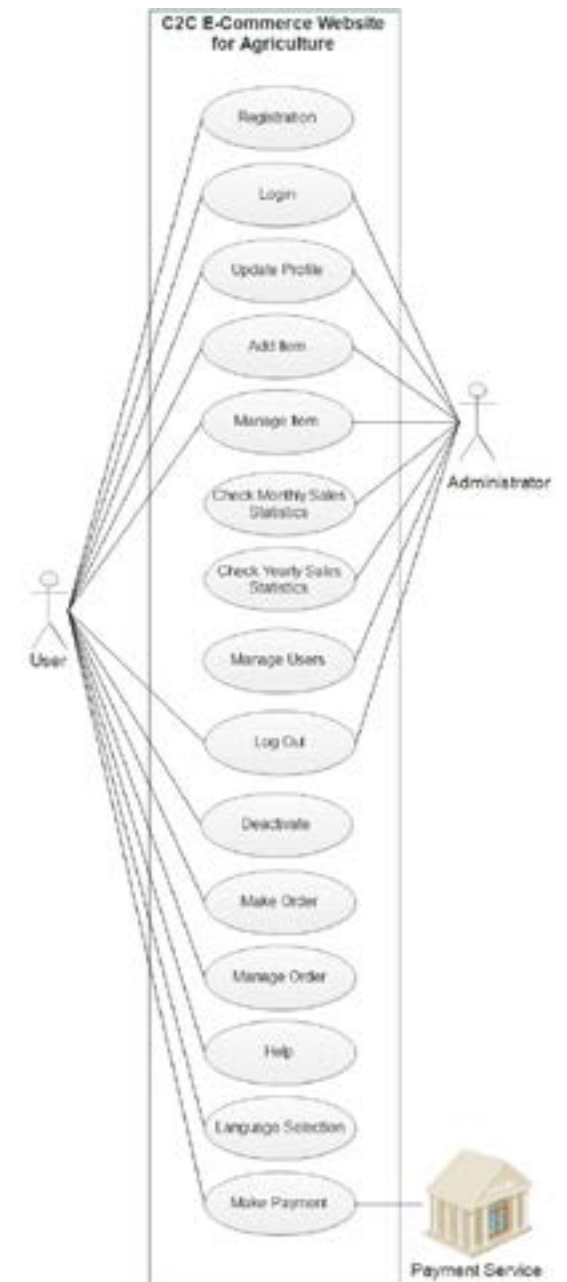


Figure 6. High level use case diagram of the proposed system

away locations as well. As mentioned before, the wastage of products due to the lack of awareness of consumers, another fact can probably be because the wastage of foods due to the long rides while the transportation is

being taken place. Thus, to avoid unnecessary expenses, direct interaction among the consumer and the cultivator is made possible through this application and also as a solution to refrain transportation from faraway locations to decrease the expense as well as the wastage of agricultural products, the application detects the current location of the consumer and displays cultivators available with the expected products by the consumer, starting from the nearest possible location onwards. Therefore, it can prevent any extra transportation costs and also all unnecessary expenses arisen due to the involvement of a third-party in the process. Furthermore, this method can broadly decrease the amount of time that is being consumed during the entire process.

V. CONCLUSION AND FURTHER WORKS

The main aim of this desktop and mobile web application is to enable the cultivators and consumers from poor to rich interact widely with each other Island wide by being at any geographical location and introduce and sell their products which are also unique to a specific geographical location by making awareness through the mobile and desktop web application of such products among the consumers from other geographical locations as well, in order to make the nation develop in the cultivation of agricultural products.

ACKNOWLEDGMENT

We thank all the past researchers who have conducted their research explored in this field of study and the anonymous referees for their immense support and their useful suggestions.

REFERENCES

Indunil, E.J.C., Gunasekara, V.S., Jayampathy, K.A.T.S., Jayasooriya, H.D.M.P., Wimalasooriya, A.K.G.P.K., Gunathilaka, T.M.A.U., 2017. The best preferred product location recommendation according to user context and the preferences, in: 2017 Seventeenth International Conference on Advances in ICT for Emerging Regions (ictcr). Presented at the 2017 Seventeenth International Conference on Advances in ICT for

Emerging Regions (ictcr), pp. 1–6. <https://doi.org/10.1109/ICTER.2017.8257820>

Lakmali, n.d. Disgruntled farmer holds a pumpkin Dansel (pics) [WWW Document]. URL <https://srilankamirror.com/photo-story/8364-disgruntled-farmer-holds-a-pumpkin-dansel-pics> (accessed 7.22.18).

Reducing food loss is key to end hunger and undernutrition by 2025 | IFPRI [WWW Document], n.d. URL <http://www.ifpri.org/blog/reducing-food-loss-key-end-hunger-and-undernutrition-2025> (accessed 7.22.18).

Shahriari, S., Shahriari, M., Gheiji, S., 2015. E-commerce and its impacts on global trend and market. *Int. J. Res. –Granthaalayah Knowl. Repos.* 34.

Ignacio Ortiz Betancourt., María del Carmen Meza Téllez.,

Mariel Terrones Castro., 2017. E-Commerce as Mechanism for Enhancing Micro and Small Enterprises: The Case of a Port Conurbated Area in the Southeast of Mexico, Vol. 8 Nr. 1: May-Aug 2017, ISSN 2411-4073

Amit Kushwaha, Vineet Kushwaha., Location Based

Services using Android Mobile Operating System, Mar 2011, ISSN: 2231-1963

Computer Literacy Statistics – 2016 (First six months) Department of Census and Statistics Sri Lanka, January - June – 2016, ISSN 2012-6565

Computer Literacy Statistics – 2017 (First six months) Department of Census and Statistics Sri Lanka, January - June – 2017, ISSN 2012-6565

Amazon.com
<https://www.amazon.com/>

Royal FloraHolland.com
<https://www.royalfloraholland.com/>

ikman.lk
<https://ikman.lk/>

Abbreviations and specific symbols

API	- Application Program Interface
CSS	- Cascading Style Sheets
E-Commerce	- Electronic-Commerce
HTML	- Hyper Text Mark-up Language
MySQL	- My Structured Query Language
PHP	- Hypertext Preprocessor
XAMPP	- Cross-Platform, Apache, MariaDB, PHP and Perl