A Virtual Reality Grocery Shopping Game to Improve Awareness for Healthy Foods in Young Adults

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***Abstract*—The current situation of obesity in children and adults is indicative of the inability to choose the right product from a typical collection of various similar products in the supermarket. To obtain a more quantitative idea regarding their shopping patterns, we have developed a prototype of a game which offers a virtual shopping experience to the player by letting him move around and shop in a virtual reality grocery store environment. The idea behind developing the game instead of a questionnaire was (1) to provide a more engaging and realistic experience, (2) to enable educators to conveniently collect the player's choices, and to tune the difficulty of the experience in real time via levelling. The game was played by 30 different people between the age group of 17 to 29 where, each of the players was made to play the game twice. In the first run, the players chose products they desire based on their knowledge and intuitions. Just before the game ended, the player was taught about the choices he had made and better products were recommended. This was achieved with the help of specially designed user friendly labels with color codes for better and faster understanding. The second run is crucial for analyzing if the player has actually benefited from this review section of the game. After the analysis, the ANOVA test on the scores obtained by the players reveal that they have indeed learnt to shop better from the game.**

Keywords-component; obesity; virtual shopping experience; adaptive; quantitatively assessed; ANOVA.

I. INTRODUCTION

With With increasing number of brands in the food sector, we sure have a lot of choices for food. But at the same time, identifying and picking up the right product from the lot has become a real challenge. This paper is an effort to mitigate this issue by collecting realistic inputs from youth and adults through a game and educating them about the nutritional quality of the products they have chosen. The current situation of obesity among the adults is indicative of the inability to choose the right product from a typical collection of various similar products in the supermarket. To obtain a more quantitative idea regarding their shopping patterns, we have developed a prototype of a game which offers a virtual shopping experience to the player by letting him move around and shop. The idea behind developing the game instead of a questionnaire is to collect the input while keeping it as close to reality as possible.

The first scene of the game is the creation of a shopping list. This enables the shopper to make a rough note of the products to be bought. The next scene stores the basic information regarding the player like name, age and gender. The subsequent scene takes the player to the shopping environment where he navigates using a keyboard. The products are selected and placed in the cart by clicking on them. In order to enhance the user friendliness, the 'check cart' option is provided which displays the items selected so far. After choosing all the products the shopping ends and the player is evaluated by assigning scores from 0-100. The final scene is where the player is taught about the choices he has made and better products are recommended. This is achieved with the help of specially designed user friendly labels with color codes for better and faster understanding. The levels are adaptive and depend on how healthy / unhealthy products the customer is choosing. Initially, healthy and unhealthy products are equally distributed. If the player makes a healthy choice, a healthy product in each category will be replaced by an unhealthy product. The contrary happens in case the player selects an unhealthy product. The products are numbered from 1 to 7, where 1, 2. and 3 are healthy and 5, 6. and 7 are unhealthy and 4 is neutral.

II. RELATED WORK

This paper is an extension of the idea that adequate knowledge regarding the nutritional aspects of food stuffs is essential for a healthy diet. It can be observed that taking the aid of technology is a smart way to address health related problems effectively. In order to improve the current scenario,

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efforts are made to develop a healthy nutrition expert system for children [1]. This is achieved by generating healthy meals for children in different ages according to different criteria including their growth stage, gender. [2] talks about the use of mobile applications for personalised messaging, as a potential tool contributing to obesity prevention and management. Technology can not only be used for correcting issues like obesity but also for finding out the root cause of the same.[3], published in Complex Systems (WCCS), Third World Conference on 2015, presents a technical methodology for investigating the cause of obesity and its link with environmental, psychological and behavioural, and biological factors. In line with these approaches, this paper aims at collecting data about the shopping styles of adults for future analysis, and also persuading them to switch over to healthier products.

III. GAME STRUCTURE

The first scene of the game is the creation of a shopping list. This is to make a rough note of the products to be bought. The next scene stores the basic information regarding the player like name, age and gender. The subsequent scene takes the player to the shopping environment where he navigates using the keyboard. The products are selected and placed in the cart by clicking on them. In order to enhance the user friendliness, the 'check cart' option is provided which displays the items selected so far. After choosing all the products the shopping ends and the player is evaluated by assigning scores on 100. These scores are used for later analysis of the effectiveness of the game using ANOVA test. The final scene is where the player is taught about the choices he has made and better products are recommended. This is achieved with the help of specially designed user friendly labels with color codes for better and faster understanding.

IV. METHOD IMPLEMENTATION

The game is mainly aimed to be played in the 4x3 passive stereo display wall. It is built on Unity3D platform. The initial structure of the game is formulated using storyboarding concept wherein, the functionalities such as, the user interface for choosing the products, placing them in cart, scores and implementation of levels are designed.

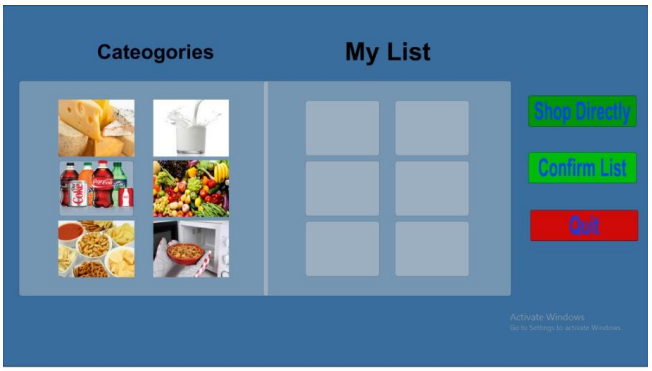
The implementation of the game starts with the first scene where the player is given the option of making a shopping list. A pre-built list of product categories is given on one side of the screen to help the player in making the list. The main aim of this feature is to make the shopping experience more realistic and ensure that the player selects all the products that he had intended to select at the start of the game.

The next scene aims at collecting basic information about the player such as name, age and gender for future reference. This information gets updated in a dat file every time a player plays this game. The Application.LoadLevel() function, called on mouse click connects the previous scene to the next scene.
The third scene is where the main shopping happens. The entire screen is divided into 2 parts in the ratio of 2:1. The bigger section is where the actual shopping happens and the smaller section has a zoomed view of the cart and the products chosen so far. In order to make the placing of the products more natural, random.Range() function is used which places the products in a random fashion within the given 3-dimensional coordinate range.
The player's motion is implemented using the first person controller. The arrow keys are used for the navigation and the B and N keys are used for the turning the cart sideways. The shopping cart is made the child of the camera to give the feel that the cart is moving along with the player.

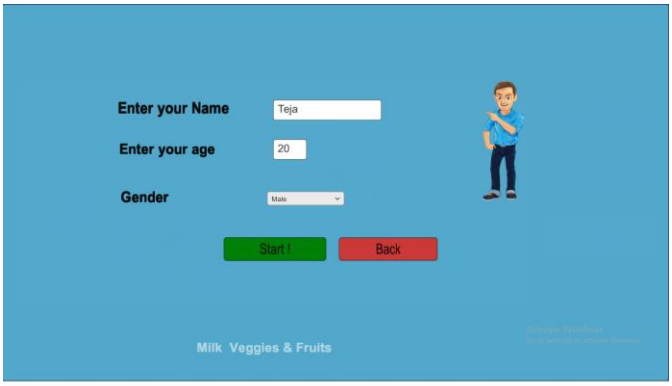
The player chooses a product by clicking on it. When the mouse is hovered over the product, its size changes which is achieved by the transform.localscale() function. The Onmousedown () function senses the mouse click and transforms its position into the cart using transform. position () function. The concept of raycasting is used to detect collision of an object with the collider. The Dontdestroyonload and singleton techniques are used throughout the game to retain specific game objects along with the changes made to it.

The current scene directs to a small GUI scene called 'Check cart' to check the contents of the cart in a more convenient and organised manner, along with its multiplicity.

Once the user clicks on 'End Game' option on the GUI scene, the game ends and the score scene follows. Here, the user gets a graphical as well as a numerical report regarding the nutritional contents in the products he has selected.



1. Making the Grocery List



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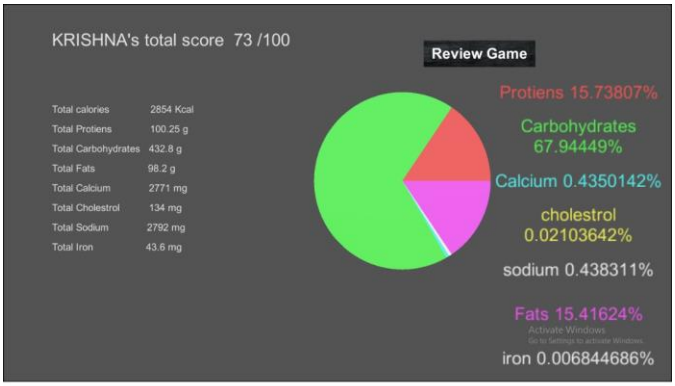
2. Collecting the User details

3. Shopping Scene

4. Checking the Contents of the cart



5. Score Scene

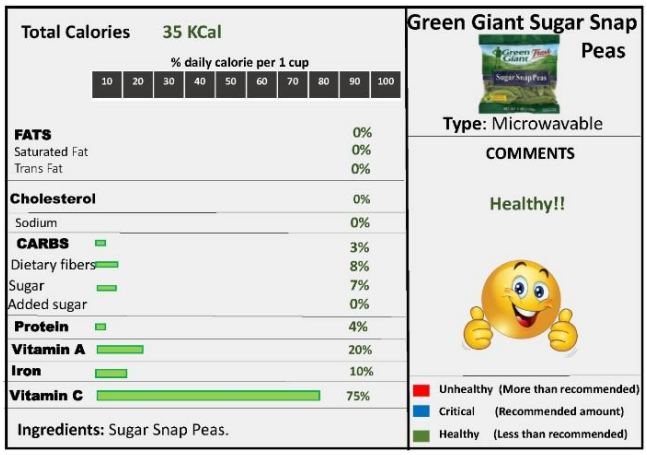
V. LEVEL IMPLEMENTATION

The levels are adaptive and depends on how healthy / unhealthy products the customer is choosing. Initially, healthy and unhealthy products are equally distributed. If the player makes a healthy choice, a healthy product in each category will be replaced by an unhealthy product. Vice versa happen in case he selects an unhealthy product. The products are numbered from 1 to 7, where 1, 2 and 3 are healthy and 5,6 and 7 are unhealthy and 4 is neutral. Initial distribution: 1,3,4,5,7. The following three cases arise:

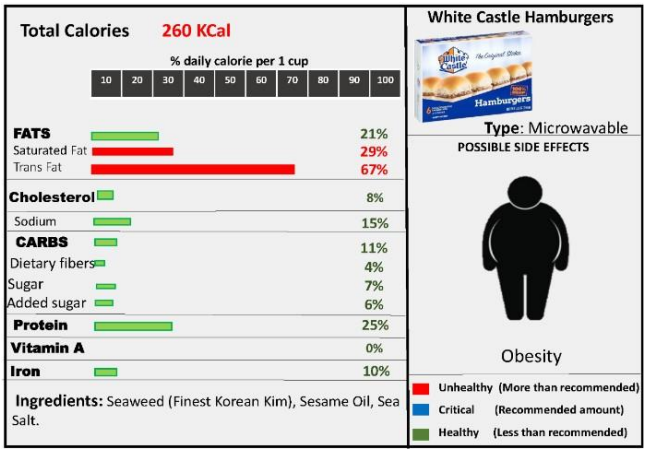
Case 1: A healthy product is selected from the category 1/2/3. All the categories of the remaining products will be modified to 1,4,5,6,7.

Case 2: An unhealthy product is selected from the category 4/5/6. All the categories of the remaining products will be modified to 1,2,3,4,7.

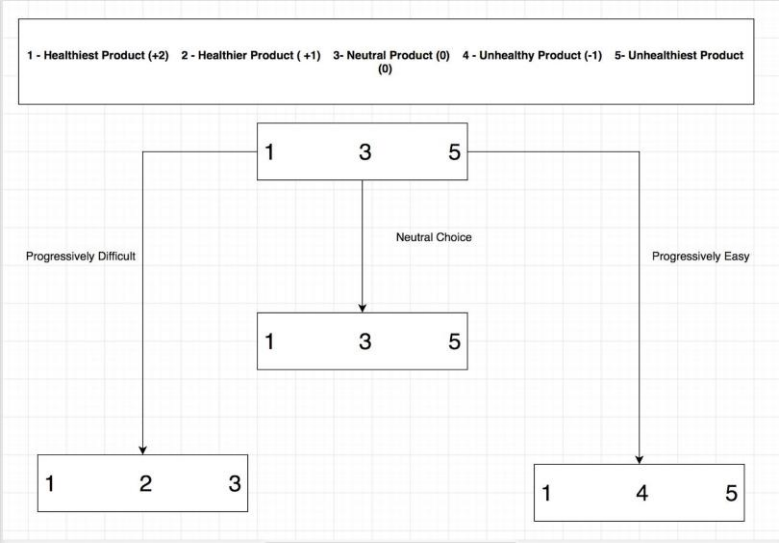
Case 3: Neutral product [4] is selected. No modification is done to the arrangement. write about modules.



6. An example of Healthy Label



7. An example of unhealthy Label



8. Level Implementation in the game.

VI. SCORE IMPLEMENTATION

To evaluate the player, all the products are broadly divided into 3 categories, namely, healthy, unhealthy and neutral. Selection of each healthy product fetches the player a score of +2, and a score of -2 in case he chooses an unhealthy product. The neutral products do not contribute to the score at all. Also, a score based on the extent of healthy shopping is displayed.

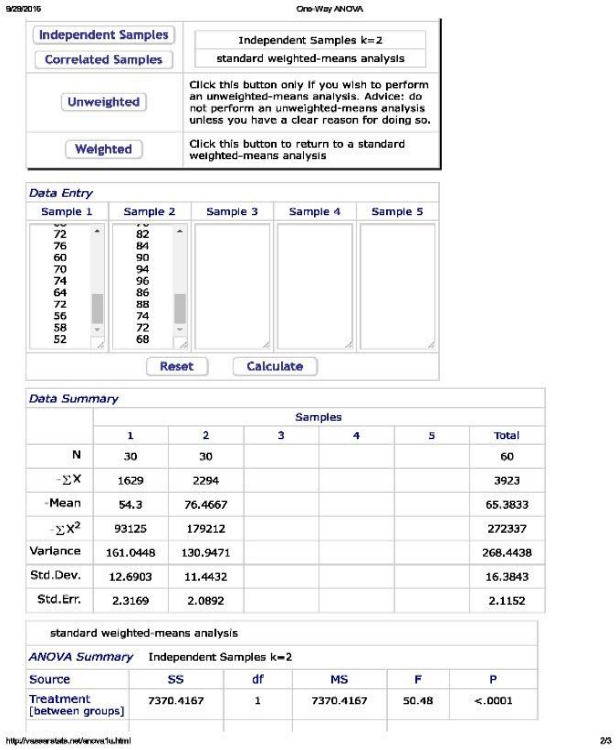
The formula used for calculating score are:

*Score % = (Number of healthy / Total Number of Products) *100.*

The last scene is to review the selections made by the player and suggest him better products in the same category. This is achieved by color-coded labels showing all the nutrients present in the product and their critical values for a healthy diet. Along with the chosen product, three other products are recommended which are more desirable from the health point of view.

VII. RESULT

The merit of the game is further quantitatively assessed using the scores collected in the data base. Each player is made to play the game twice and the scores obtained before and after studying the labels are recorded in Group 1 and Group 2 respectively. The ANOVA test of significance is applied on the data and the p value obtained is <0.0001 proving the hypothesis that, the game has had a positive impact on the players, true. Hence, we can conclude that the game has successfully achieved its aim of educating the players and has convinced them to switch over to healthier food products.



9. ANOVA Test application on our sample size

VIII. FUTURE SCOPE

The present model of game can be further enhanced by the inclusion of medical details of the individual players so that the recommendation of the products can be made more accurate and personalised. Also, the range of products can be increased to give the players an even more realistic shopping experience. The information collected in course of the regarding the shopping patterns can play a crucial role in analysing and predicting various health issues related to eating habits, in adults. Also, new practices and measures can be devised to deals with such problems.

IX. CONCLUSION

To conclude, it might be stated that the game has been successful in enhancing the knowledge of the players about the food products that they choose in their day to day lives. It has also helped in understanding the shopping trends and preferences of people belonging to different age groups.

REFERENCES

1. Maryam Hazman and Amira M. Idrees, ”A healthy nutrition expert system for children”, Iasi, Romania. **DOI:** 10.1109/EHB. 2015.7391367 ,E-Health and Bioengineering Conference (EHB), 28 January 2016.
2. Anne Moorhead , Raymond Bond and Huri Zheng, “Smart food: Crowdsourcing of experts in nutrition and non-experts in identifying calories of meals using smartphone as a potential tool contributing to obesity prevention and management”,Washington, DC, USA,**DOI:** 10.1109/BIBM.2015.7359959, Bioinformatics and Biomedicine (BIBM), IEEE International Conference, 17 December 2015.
3. Mariem Jelassi, Slimane Ben Miled and Narjes Bellamine Ben Saoud, “Obesity determinants: A systematic review”,Marrakech, Morocco,**DOI:** 10.1109/ICoCS.2015.7483277 Complex Systems (WCCS),Third World Conference on 2015, 02 June 2016.
4. Adam Drewnowski ,Lisa Sutherland and Dr. Yoni Freedhoff, ”Personalize Fooducate feature of Fooducate website”.
5. The Academy of Nutrition and Dietetics, “Eat Right Healthy food choices for young adults”.
6. US Food and drug, “How to Understand and Use the Nutrition Facts Label”.
7. The stack Overflow,”Unity 3d tags”, *https://stackoverflow.com/tags/unity3d…*
8. The unity 3d tutorials and answers,” Unity - Learn - Modules”, *https://unity3d.com/learn/tutorials*