Augmented reality in nutrition education

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Abstract. This research synthesizes findings of studies on augmented reality in nutritional education as a solution to the nutrition knowledge problem. Journals examined from 2010 to 2019. This paper focuses on the issue of nutrition and augmented reality knowledge as one of the media solutions for nutrition education and how the influence of providing nutrition knowledge through augmented reality. With the presence of nutrition knowledge through this Augmented Reality users of various age ranges can use it and complete a whole set of programmed, and users can change the eating behaviour and diet, users are interested and prefer to learn nutrition, and are proven to provide convenience and minimize boredom in learning the material. The results of the test received a very good rating which assessed that Augmented Reality application is very useful and makes users more quickly understand and remember the material in nutrition learning. We expect the number of positive responses from the use of augmented reality in nutrition education to be more developed such technology to support the improvement of education and nutrition behaviour of the community.

1. Introduction
The lack of community awareness on nutritional intake caused various nutritional problems such as underweight, stunting, overweight, obesity and the emergence of various degenerative diseases. Various factors cause nutritional problems such as lack or excess consumption of food, poor food processing, consumption of junk food and excessive fast food [1-7]. It takes good nutritional knowledge as one way to avoid the problem, in addition to the knowledge of the type of foodstuffs and good processing, it is also necessary to education in regulating portions of food or beverages consumed [3,4,6,8]. Nutritional education community can be supported with nutrition education and counseling and media nutrition information, in the era of Technology 4.0 this has evolved various kinds of information technology, one of which is augmented reality designed as nutrition information media [2,5,6,19,20].

Augmented reality as a nutritional information media now has been made a lot [11]. One of them used to assists in the determination of eating servings [9,14,15], as a nutritional information in traditional foods [10], as a medium of nutritional information for diabetics [11-12], as a medium of fruits nutritional information [13].

This research aims to assess the influence of augmented reality use in nutritional education as one of the solution in facing nutritious problem, it is in line with the need for an interesting nutritional education to communities to raise awareness about the importance of observing nutrition. Educators and researchers can use this information to identify unanswered issues or questions in the literature and define the direction of future research regarding the trend of augmented reality in nutritional education.
2. Methods
The literature review is identified by exploring the Science Direct and Google Scholar database, followed by Scopus by entering the keywords “augmented reality” and “nutrition education”. As a result, there are several articles in the last 10 years with vulnerable time between 2010 and 2019. The article obtained is then read, analysed and encoded using a Spreadsheet program.

2.1. Coding scheme
The coding scheme is adapted from a structured/systemic approach to library review. The approach using the four main categories in analyzing the article, namely the following:
- Basic Data: author, publication year, journal, place of study
- Research methods: research approaches, methods, themes, data collection, analytical methods, research results
- Analysis of content: augmented reality, AR in nutritional education, influence of use of augmented reality in nutritional education
- Discussion: issues discussed, future hints, personal commentary

| Basic Data          | Research methods                                                                 | Content analysis                                                                 | Discussion                                                                 |
|---------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Cica Yulia et al.   | The making of the application starts with story board design, 3D objects of traditional Sundanese food design using blender software and making videos about the making of the food. To make the videos, this paper uses Wondershare Filmora software. In an attempt of making AR Ma’Ugiz compatible to many platform, a Unity 3D is employed. | This research contains the development of augmented reality as a media nutrition education in traditional food. For teenagers. | The main findings show that teenager has a low nutrition knowledge in traditional food it is causing low health quality so that the software is made with augmented reality technology as a solution to the nutritional knowledge problem in traditional food. |
| 2018                |                                                                                  |                                                                                 |                                                                           |
| Can Mobile Augmented Reality Systems Assist in Portion Estimation? A User Study | Do a comparison of the original foodstuffs with replicas used in AR. The percentage of errors used to compare estimates serves the size of accuracy. Then test the usability of the AR application. | This research presents an evaluation of mobile augmented reality approaches for portion estimation and offers comparisons with conventional portion estimation approaches. | Cases of obesity dramatically increase the risk of cardiovascular disease and diabetes mellitus type 2, as a solution to create an augmented reality as a determinant of nutritional value and portions of food that will be consumed by users. |
Table 1. Cont.

| Basic Data | Research methods | Content analysis | Discussion |
|------------|------------------|------------------|------------|
| Fruitify: Nutritionally Augmenting Fruits through Markerless-Based Augmented Reality | Conducting an evaluation done mainly in young children who studied undergraduate program and aged between 18 and 25 years purposive, as recruitment criteria, only participants who have Android-based phone selected for compatibility reason with the application being evaluated. | This paper examines an AR application containing a fruit nutrient content called Fruitify, before discussing the reliability tests performed on the application and end users. | Decrease in fruit consumption increases cardiovascular disease and obesity in children so that the augmented reality software is built to display nutritional information on fruits. |
| Training of Carbohydrate Estimation for People with Diabetes Using Mobile Augmented Reality | Conducted research on eight adult patients with diabetes mellitus type 1. At the beginning of the study of patients introduced AR software. Patients are required to redraw real food with 3D form on the smartphone screen and from the image the estimated carbohydrate content is calculated. Patients are instructed to use the application during the study period. For evaluation purposes, the test measures the quality of carbohydrate estimation designed and performed at the beginning and end of the study. | This study contains pilot studies analyzing the effects of mobile augmented reality applications (BEAR) on the accuracy of carbohydrate estimation of diabetic patients. | Improper calculation of carbohydrates as a guideline for the treatment of diabetes can be a source of errors that cause problems in glycemic control, the solution is augmented reality as a medium to estimate the intake of carbohydrate sufferers diabetes. |
| AR DeepCalorieCam: An iOS App for Food Calorie Estimation with Augmented Reality | Estimate An estimated calorie-based food image which is an estimate of the simultaneous food and calorie categories for food photos and collects calorie-annotated prescription data from online cooking recipe sites, and generates food calories directly from food photos containing only one dish. | This research contains how this AR app works and how the calorie forecasts accuracy of the photos the user takes. | Create an automatic calorie estimation application for food photos taken by users, as food intake information will be consumed by the user in order to control food consumption. |
Table 1. Cont.

| Basic Data | Research methods | Content analysis | Discussion |
|------------|------------------|------------------|------------|
| **Food Talks: visual and interaction principles for representing environmental and nutritional food information in augmented reality** | Collect information from users and compare information that users get from static media and AR, then test usability from AR | The research reveals that AR can be a credible medium in the food industry and provides learning of visual design and interaction to inform designers in the industry | The lack of a community in the sense of information on the label food and beverage packaging makes the public become lazy to use labels on the packaging, as a solution Augmented reality that contains nutritional information on food labels are often poorly understood meaning. |
| Nicolas Henchoz | 2019 | | |

**Promoting healthier food choices with the application of Augmented Reality**

| **Bence Csakvary** | **2017** | **The method used is an experiment on samples taken randomly. To check whether the nutritional information provided by these tools affects healthy food choices.** | **In this study, nutritional fact table as an example of the label behind the packaging, the traffic light logo as an example of the front label packaging, and the mobile application of augmented reality as a new way are proposed to provide the methods of nutritional information compared and tested.** | **The influence of nutritional information on food packaging labels does not have a major impact on food selection of people causing a high level of low nutritional food consumption, so that made augmented reality that can classify food packaging that will be purchased healthy users or not as an effort to reduce consumption of low nutritional foods in the community.** |
| | | | |

3. **Literature review results**

3.1. **Augmented reality**

**Augmented reality** is a technology that combines two-dimensional and three-dimensional virtual objects into a real three-dimensional environment and then projects the virtual objects in real time either in two dimensions or three dimensions [14]. Basically Augmented Reality has the advantage of providing experience and understanding for learning subjects. Augmented Reality is proven to provide convenience and minimize boredom in learning a material. From the test results obtained 88.75% assessment assessed that Augmented Reality applications are very useful in nutritional learning [9]. Augmented reality created can use two ways: scanning the original image and scanning the image that has been created on the book by the designer [9][10][11][12][13][14].

3.2. **Augmented reality in nutritional education**

**Augmented reality in nutritional education** is a media information and nutrition education that is presented in the form of two-dimensional and three-dimensional virtual objects into a real three-dimensional environment and projecting the virtual objects in real time both in two dimensions or three dimensions [14]. There have been many technologies used to educate others such as the use of learning media. The technology that is currently developed to educate the community is a widely-Augmented Reality (AR) technology. The working principle of this technology in general is to combine the real environment in this form of nutritional information such as good foodstuffs in consumption, appropriate
portions to consume, with pre-designed virtual objects. This technology is very possible to use as a means of delivering information that can educate the community [6].

Based on the background that has been discussed, than an idea that can be a solution is needed. The wider utilization of AR technology is evidenced by the various research that has been carried out coupled with the use of mobile devices that increasingly extends the various layers of society to be a very supportive factor to make a public health education media on nutrition. The use of AR technology to make educational media will be better and can be presented more attractive to give understanding to the community related to the information to overcome nutritional problems.

3.3. Effect of using Augmented reality in Nutritional Education

With the advent of various media nutrition education in the form of augmented reality, making users more interested and more happy to learn nutrition, and Augmented Reality proved to provide convenience and minimize boredom in learning a material. From the test results obtained an excellent assessment that assessed that Augmented Reality application is very useful and makes users more quickly understand and remember the material in nutritional learning [9][12][13][14][15].

Users of augmented reality nutrition from various age ranges can use it and complete an entire set of programmed, participants thoroughly enjoy practical experience with augmented reality to get nutritional related information. These results also show AR prospects for providing nutritional and health-related information, and users can change their diet and dietary behaviors [9][10][11][12][16][17][18].

The number of positive responses from the use of augmented reality in nutritional education is expected to be more developed such technology to support the improvement of education and nutritional behavior of the community.

4. Conclusions

The lack of awareness and public knowledge of the importance of nutrition greatly affect the health conditions of the community. So in this era of 4.0 emerged various media nutritional information in order to improve the knowledge of the community one of which is a nutritional information media with the use of Augmented Reality. Augmented Reality in nutrition education is an information media and nutritional education that is presented in the form of two-dimensional and three-dimensional virtual objects into a real three-dimensional environment and projecting virtual objects in real time either in two dimensions or three dimensions. The working principle of this technology in general is to combine the real environment in this form of nutritional information such as good foodstuff to consume, appropriate portions to consume, with pre-designed virtual objects. With the knowledge of nutrition through augmented reality it makes users more interested and more happy to learn nutrition, and it is proven to provide convenience and minimize boredom in studying a material. The results of the test received a very good rating which assessed that Augmented Reality application is very useful and makes users more quickly understand and remember the material in nutritional learning. Users of augmented reality nutrition from different age ranges can use it and complete the entire set programmed, and users can change their eating behaviors and diet patterns. Many positive responses from the use of augmented reality in nutritional education are expected to be more developed such technologies to support the improvement of education and nutritional behavior of the community.

Rapid Application Development methods can build a system based on Internet of Thing's (IOT). The success of the show with the device IOT testing to try testing with measurable control irrigation pumps. In this study, the average delay that occurs when the control is 4.8 seconds of orders delivered from smartphones to NodeMCU forwarded to the relay.

The design focuses on the development of testing methods, it is advisable for the implementation into devices smarter so that it can control the smart irrigation with the addition of weather sensors, soil acidity and so forth.
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