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## **AR-Phototainment: An Augmented Reality Catch Game and Self-Service Photo Booth for Entertainment**

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### **Abstract**

In this study, we developed a product that can combine object capture games and photo booths that implement Augmented Reality. This application is operated only using the user's body movements detected by the motion sensor used, namely Microsoft Kinect V2. This application was built as an entertainment facility that can be placed in the lobby of a building. With this goal in mind, this application is called AR-Phototainment (Augmented Reality Photo Booth and Entertainment).

**Keywords:** Augmented Reality; Catch Game; Self-Service Photo Booth; Microsoft Kinect.

### **1. Introduction**

Augmented Reality (AR) is one technology that has a high level of interest [1]. AR is a technology that combines real and virtual objects in a real-time interactive real-world environment that integrates 3D objects, namely virtual objects that are integrated with the real world [2]. AR systems have been used in various fields, including health, automotive, and education, in the world of entertainment [3]. AR is the most widely used in the entertainment world. One form of entertainment that is usually presented is a game application.

In recent times, several AR game prototypes have been well developed and targeted to be able to operate indoors and outdoors.

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Evaluation studies have shown that the AR game concept is feasible and can be further developed [3]. AR technology in-game applications can be explored again and combined with other functions. One form of idea to develop AR games further is to combine AR games with the field of photography.

Photography is an act where someone takes pictures and processes them. There are different types of photography styles such as architectural photography, fashion photography, and human photography. The media for taking pictures also vary, ranging from digital cameras to smartphones. One of the photographic media is photo booth media, which is a kiosk or vending machine that contains a camera and film processor where people can style it and take pictures [4].

The rapid development of technology introduces many new photographic techniques such as augmented technology. One of the most popular augmented technology mobile photography applications is Instagram, where this application allows users to add virtual accessories to their faces [4].

From the results of initial monitoring, conventional photo booths at malls or entertainment centers such as Timezone are empty of visitors. It can be assumed that people find it monotonous because there is nothing special about it. From this research problem, we have an idea to develop a digital photo booth that is combined with AR games and implements augmented reality that can attract people to try and use it.

Therefore, this study aims to combine object capture AR games and self-service photo booths that can interact directly with the user's body movements in real-time. Users can play games that are presented by moving the body to pick up the objects needed to increase the score and avoid objects that can reduce the user's life. After the user has played, the user can choose to replay the game or take a photo session as a memento.

During the COVID-19 pandemic, interactions between products and users must be minimized to reduce the rapid spread of the virus just by touching it. Therefore, this technology uses a motion sensor (Microsoft Kinect V2) to detect the user's motion so that the user does not have to interact directly with the product presented. The games presented are also themed on COVID-19, namely collecting health products needed by users during the pandemic (soap and hand sanitizer) and users must avoid the Coronavirus so as not to reduce the lives they have. Each game has three lives.

The games in this product can be played spontaneously without having to use a device that makes it difficult for the user. We hope that AR can become a key technology that can be more realistic and create real experiences compared to Virtual Reality (VR).

By combining self-service photo booths and object capture games that are intended as a means of entertainment, we have named it AR-Phototainment (Augmented Reality Photo Booth and Entertainment). This application will be placed in the main lobby of a building to provide entertainment to visitors while waiting in the building so they don't get bored.

## 2. Related Work

Catch the Egg game is one of the most popular childhood games. This game helps develop the player's concentration power. This game is easy to play and a lot of fun. Players have to slide the basket to collect the eggs that the chickens release to get a score. If the player fails, the egg will break and reduce the player's life [5]. Because the gameplay of this game is very simple, many developers have made similar games with different gameplay. However, this game has not yet been implemented in the form of augmented reality.

Leeson and his colleagues [4] built a self-service photo booth that implements AR under the name BildBox!. This application allows users to try on several different virtual costumes. This development also uses the Unity game engine and Microsoft's Kinect v2 sensor as a camera to capture user-driven movements. This application chooses the email sharing feature so that users can get the photos that have been taken. However, the app hopes to have a QRCode sharing feature in the future.

From the two studies above, the researchers tried to combine the two studies into one, namely building an AR catch game equipped with a self-service photo booth feature using Kinect as a player detection sensor and adding the QRCode sharing feature to the application to be built.

## 3. Materials and Methods

### 3.1. Hardware and software

The main purpose of this research is to develop AR-Phototainment, which is a game for capturing medical devices (catch the soap game) equipped with a photo booth feature which is an implementation of Augmented Reality technology. AR-Phototainment development uses hardware and software that are easily found in the market.

The hardware needed is a motion sensor (Microsoft Kinect V2) to detect the user's body movements and a personal computer with a minimum of an Intel® Core i7-6700K 4.2 GHz CPU, NVIDIA® GeForce GTX 1080 graphics card, 32GB DDR4 RAM, and a 240GB SSD. Equipped with a large television screen with a minimum size of 42inch and a Kinect stand as a place to store the Kinect sensor.

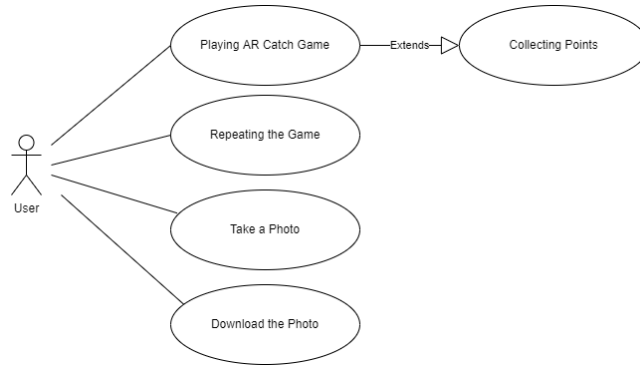
The software used to build AR-Phototainment is the 2019 version of Unity as a game engine for developing applications, Kinect for Windows SDK to integrate motion sensors, and Visual Studio 2019 to code the AR-Phototainment program.



**Figure 1:** AR-Phototainment app overview

### 3.2. Use case diagram

In running this game the user has the right of access to play the catch the soap game, choose the model, and take pictures.

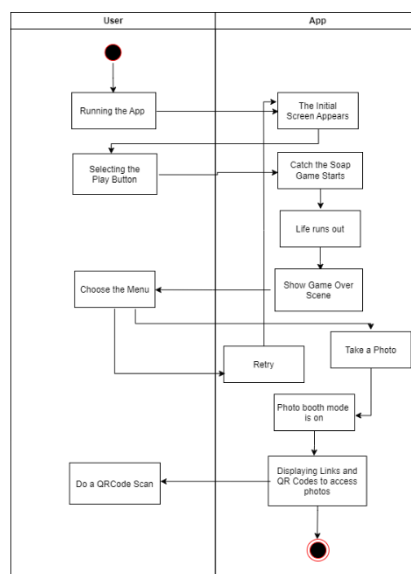


**Figure 2:** use case diagram AR-Phototainment

### 3.3. Activity diagram

The first time the user runs the application, the system will detect the presence of the user, and the system displays the home screen and the play button. The play button will start the game and the user can play the catch game until the lives run out, after the lives run out the application will display a game over the scene with 2 options, namely Retry and Take a Photo. Retry will restart the game from the beginning. Taking a Photo will turn the game into photobooth mode.

In photobooth mode, the image will be taken after the countdown is complete. Users can access the photo via a link or QR Code which will be displayed after the photo is taken.



**Figure 3:** activity diagram AR-Phototainment

### 3.4. User and gesture detection

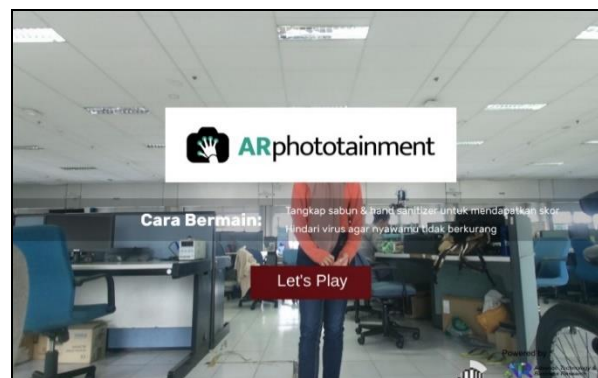
This game uses the Microsoft Kinect Camera as a sensor to detect the presence and movement of the user. The movements that will be read by the system to run the game are head movements, palm movements, and hand gripping. Only one user can interact and play the catch game, a user who can interact is indicated by the appearance of a bucket object above his head.

### 3.5. Game mechanics

The in-game menu can be operated using palm gestures, palm direction to move the cursor, and palm grip to select menus. When the catch game starts, a bucket object will appear above the user's head which functions to catch hand sanitizer, soap, and viruses. Users will get points if they manage to catch hand sanitizer and soap objects using a bucket. If the user catches a virus, the health bar will decrease, when the health bar runs out, the game will end. When the game ends, a game over scene will appear which has 2 options, namely Retry and Take a Photo, if the user selects the retry menu, the game will start from the beginning. If the user selects Take a Photo, the photobooth mode will be active and a countdown will appear. Users can access photos via the link and QR code displayed by the system.

### 3.6. User interface implementation

In photobooth mode, the image will be taken after the countdown is complete. Users can access the photo via a link or QR Code which will be displayed after the photo is taken.



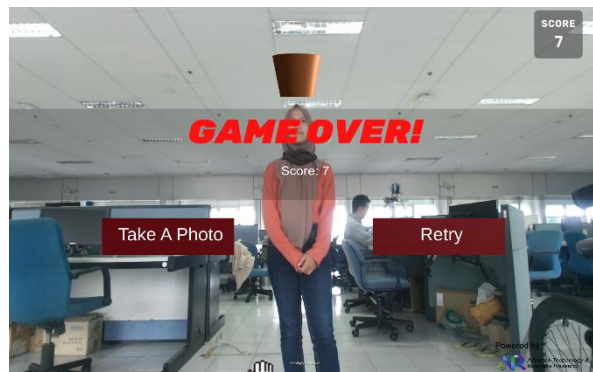
**Figure 4:** AR-Phototainment main page

The main page view is initiated when the application is run. On the main page, there is an explanation of how to play and the "Let's Play" button to start the game (Figure 4). After the user hovers over the "Let's Play" button, the user will immediately enter the soap catch game which has been equipped with a 3D bucket object on the user's head to capture medical equipment. On the left, there is a heart that shows the user's life. When the game starts, the user has 3 hearts. On the right, there is a score to show how many scores have been obtained by the user by collecting medical equipment into the bucket provided (Figure 5).



**Figure 5:** the user plays "Catch the Soap" Game

When the game has finished, the display that will be initiated is the "Game Over" display. On this screen there are two options, namely, "Take a Photo" or "Retry". "Retry" if the user wants to repeat the game. If not, the user can proceed to the photo booth feature.



**Figure 6:** the display when the game ends

For the photo booth feature, there will be a five-second countdown to give users time to pose. After five seconds, the image will be captured and uploaded to the image link, so that the user can download the captured image.



**Figure 7:** photo booth feature & QR Code to download the image

#### 4. Results and Discussions

##### 3.7. Application Testing

Before testing is carried out on users, the researchers themselves test the application using the black-box testing method. This test is carried out to test whether the AR-Phototainment application is already running as it functions.

From the test results using the black-box testing method, it can be seen in Figure 8 that the AR-Phototainment application can run as expected. The next step can be done, namely testing the user.

No	Activity / Menu	Expected Result	Achievement Rate	
			Yes	No
1.	The user runs the application	Appears the initial display of the application and the background music is running	√	
2.	The user standing in front of Kinect sensor	Kinect will detect the presence of the user	√	
3.	The user waving to the sensor	Kinect will detect the user's hand movement and make it as a cursor	√	
4.	The user clenched their fist to the sensor	Kinect detects grip gestures as in-app input	√	
5.	The user hovers over the Lets Play button and makes a fist	The game will start and the display changes to play mode	√	
		Kinect detects the user's head, then raises a bucket object above his head	√	
		Virus objects, soap and hand sanitizers start to fall randomly	√	
6.	The user moves their head to the sensor	The bucket object will follow the movement of the user's head	√	
7.	The user directs the bucket object to the soap or hand sanitizer object	The bucket will catch the soap or hand sanitizer object, then the score will increase	√	
8.	The user directs the image object to the virus	The bucket will catch the virus object, then the life will be reduced	√	
9.	The user runs out of life	Game over, then the Retry or Take a Photo option appears	√	
10.	The user chooses Retry	The game will start from the beginning	√	
11.	The user chooses Take a Photo	The display will change to Photo Booth mode	√	
		The final score appears	√	
		A countdown appears to take photos	√	
		After the photo is taken, it will be uploaded directly to the internet	√	
		A QR Code appears	√	
12.	The user scans the QR Code	Users can access photos that have been taken	√	
		After a while the application will return to the initial screen	√	

Figure 8: application test result

##### 3.8. Alpha Testing

After testing the application using the black-box testing method, the user is tested again using the questionnaire method. The purpose of this study was to determine customer satisfaction with the product that was built. Users will answer the questionnaire using the Likert scale method, where there will be a scale from 1 to 5, a scale of one indicates disagreement and a scale of 5 indicates agreement with the given statement. Description

of scale and statement as follows:

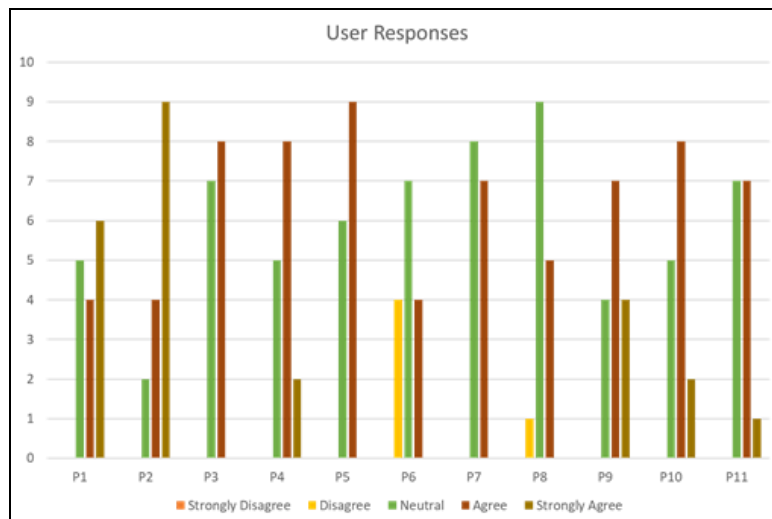
1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

**Table 1:** User questionnaire

No	Statement
1	Gesture interaction is easy to understand and execute
2	In-game movements correspond to real movements
3	User Interface design is easy to use when interacting
4	The game information is clear
5	The placement of the 3D bucket object is appropriate in the user's head while playing
6	Cursor control is easy to move and there is no delay
7	Easy game to play
8	There is no delay between actual user movements and in-game movements
9	The time allotted (5 seconds) to take a photo is enough
10	Photo results are easy to access and download
11	Overall this application is interesting and entertaining

This test selects 15 people in the age range of 20-30 years as participants. 3 of them have tried a photo booth that uses a Kinect sensor. During the COVID-19 pandemic, testing was carried out using a health protocol. All participants and examiners must be tested for antigen first (1x24 hours). Before starting, participants' body temperature was also checked. Participants also used masks and hand sanitizers before being tested. The product is also sprayed with disinfectant before testing.

The time for testing is not determined, but participants can only repeat the game once and then immediately take a photo session. The results of user responses can be seen in the image below.



**Figure 9:** participant responses to questionnaire test

From Figure 9, several conclusions can be drawn. Half of the participants agreed that the interactions on AR-Phototainment were easy to understand and execute. This shows that the user interaction function needs to be



improved again. For the user control function, half of them felt neutral for the accuracy of the cursor following the user's movement, while four of them did not feel the same. Therefore, the cursor function needs to be improved again. For participants, this application is quite entertaining and interesting to the market.

#### **4. Conclusion**

From the whole discussion, it can be concluded that object capture games and self-service photo booths can be combined to become a product. Researchers have succeeded in adding the QR-Code sharing feature to share photos that have been taken. From the results of testing to users, this product is worthy of being marketed, but several things need to be improved such as the sensitivity level of the cursor/motion sensor to be in tune with the user's movements.

For further research, it is hoped that this product can add features to add other game options and feature costumes or filters for the photo booth menu.

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