**Duck Catching Game using Kinect V1 and Speech Recognition**

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**This game is based on the old Duck Game released for the NES (Nintendo Entertainment System) in which the player had to kill all the ducks in the game to win.**

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# 1. Purpose of the game

## 1.1 Game Concept

The main character is an anime-based human that needs to collect the ducks to increase the score all the while kicking the snakes before being killed by them. The game ends when the health bar is at its lowest and the user dies.

## 1.2 Game Genre

This is a shooter-type game based on the original Duck Hunt game that was first released in Japan in 1984, on the Nintendo Entertainment System (NES) video game console (1), the 2rd game console ever released by Nintendo after Color TV-Game, “a series of five dedicated home consoles” (2)

## 1.3 Objective

The main goal of this project was to create a Duck Hunt based game, with the Kinect Hardware. In this game, the player’s body is displayed as the in-game character. The player will have to use their body parts according to the game instructions to collect the ducks and destroy the enemies.

The game’s goal is to collect as many ducks as possible to level up the score before being bitten by the snakes, which are the enemies that need to be destroyed. Being an endless game, the ducks spawn continuously until the game ends making it very competitive and fun to play as the difficulty increases every 10 minutes.

## 1.4 Front-End

This will include a Start Menu that takes the player to the actual gameplay. When the word “Play” is spoken or "Play" button is chosen using the hand cursor.

The menu has four buttons - Play, High Score, Instructions and Quit - each carrying different functions in relation to the functionality of the game.

As any other game, the Play button is used to start the game and it takes the user to the scenery, which is that of a field with grass and trees, specific to the environment in which both ducks and snakes can be found. To access the high score as well you can press the “High Score” button or say, “High Score”. The same applies to quit the game entirely and to view the Instructions – which is used to let the user know how to play the game.

## 1.5 In-Game Menus

A Pause Menu will be included which will allow the user to resume the game, restart the game from the beginning and navigate to the main menu. All this will be done via speech recognition making it easier for the player to access the menu while away from the computer.

## 1.6 Control Mechanisms

To control the game the player will be using their bodies, specifically their hands to collect the ducks, their feet to kick the enemies as well their heads to collect the health bonuses which give a health boost and increase the lifespan of the character.

The menus will be controlled with a hand cursor recognized by the right hand, or via speech.

## 1.7 The Game

The player will be using their hands to catch the ducks - as supposed to using a gun to shoot them in the original game. Score is increased by one with every duck caught and it keeps increasing until defeated.

Snakes were included as enemies that try to harm the in-game character and can be destroyed when kicked, otherwise they will eat away the health bar until it is at its lowest and that is when the game ends. At the end of the game, the highest score is displayed on the screen and can be reset at will.

In the game, the ducks are spawned continuously until the character dies and this makes for a fun and competitive never-ending game to play as well as a good fitness game for those who don’t have time or the energy to attend the gym since it involves a continuous hand and feet movement.

# 2. Gestures identified as appropriate for this application

## 2.1 Myo Armband

Originally, the idea was to create a shooter game using a gun-like hand gesture as per to shoot the ducks in the game. Although the idea was good, we believed that it was not complex enough for the amount of people in our team so we have decided to consider other hardware options that seemed to involve a much more significant amount of research and complexity for a group of three people.

Fig. 1 Gun-like hand gesture

## 2.2 Leap Motion Controllers

The Leap Motion Controllers seemed like another decent choice for the game as the thought of using them inside the game with an in-game gun seemed like a good idea. The plan was to use the hands from inside the game to hold the weapons and fire at the ducks. Eventually we came to the conclusion that using the player’s full body would be a better option for a much more fun experience, than just using the hands and unfortunately the leap motion controllers are not capable of recording anything outside the boundary of hand gesture so we have excluded this option also.

## 2.2 Kinect V2

We have decided to use the Kinect Hardware as we believe it is the best option as it can use both the hands and the player’s body movements. The original thought of shooting the ducks was changed into catching the ducks and kicking the enemies as it gives a more unique and interesting experience for everyone to have playing as it is a fitness friendly and comedic gameplay.

After a lot of research we, as a team, found out that to build a game as such with the second version of Kinect would be very difficult as all the libraries and tutorials (3) for the movement of the body parts were either outdated, hidden, paid or deleted since the both the Kinect V2 and V1 Hardware are not used anymore (4) in the gaming industry for 3 main reasons:

1. People in general didn’t want to play Xbox One games for Kinect since they were not considered the best
2. Unfortunately, Kinect v2 is a “more closed ecosystem than Kinect v1 and this has not been that good for makers” (4)
3. The sensor has too many cables and it requires a desk of their own which is very inefficient for people with small homes

## 2.3 Kinect V1

Having both Kinects researched, we eventually decided to use Kinect V1 instead of Kinect V2 as both Hardware are seemingly similar in terms of the overall use, the main difference being that Kinect version two includes 25 joints as supposed to version one which includes 20. Although the switch from the Kinect with a higher number of joints to the one with less sounds like a terrible idea, it wouldn’t affect our gameplay as the only extra joints are fingers and toes which are not required. Therefore, there would be no need to use the newest version.

## 2.4 Speech Recognition

At the start, we have thought of using the Microphone from the Kinect Hardware, but after a lot of research we have found out that there isn’t much documentation about it for the Unity Platform and being new to this technology we wouldn’t be able to figure out how to implement it without some information available to us, at least not for version one. The newest Kinect version had more documentation available about Speech Recognition, but it wasn’t possible to implement it to version one as both Kinects require different SDK’s and connect differently.

After a long, throughout research, we have decided to turn to Unity Speech Recognition as there are a lot more tutorials and explanations on how to implement it as well as solutions for issues that might be encountered.

# 3. Hardware used in creating the application

## 3.1 Kinect

Formerly known as Project Natal, this hardware is a device used as a “controller for Microsoft’s Xbox 360 and Xbox One gaming systems” (5). It uses video data collected by the Kinect Camera and audio data from the Kinect Microphone to interact with games, movies and other entertainment programmes available.

The capability of this hardware to “distinguishing the user's gestures, voice commands, facial characteristics, skeletal data and full body motions” (5) allows the programmes using it to identify individual users and the names connected to them which plays a significant role in researching fields such as “IT health, education, home automation and in health technology” (5).

An example of research project that has been implemented with the Kinect is translating sign language into spoken as well as written language. Researchers from China have developed a the “Kinect Sign Language Translator” (6), with Microsoft Research that makes it easier for people who are unable to use their vocal chords, to communicate with others. Just like there are different languages spoken in different countries, “there are more than 300 sign languages” (7) in the world, as surprisingly as that sounds. Kinect not only allows communication with people who do not understand it, but also with those who have learnt a different one, to communicate with each other.

## 3.1.1 About Kinect V1

Putting it into simple words, Kinect V1 is a Smart Camera for Xbox 360 - released on Xbox 360 in November 2010 and on Microsoft Windows in February 2012 - that uses body gestures or speech commands as controllers. Its camera uses infrared light which accounts for a great skeleton tracking, even at night, and it can track 20 points in the body for one player, and as many as 48 points in the body for up to two players at the same time (8).

## 3.1.2 Reason of Choice

## 3.1.3 Comparing Kinect V1 and Kinect V2

## 3.2 Unity Speech Recognition

## 3.2.1 Speech Recognition

## 3.2.2 About Unity Speech Recognition

## 3.2.3 Reason of Choice

## 3.2.4 Comparing Kinect V1 Speech Recognition and Unity Speech Recognition

# 4. Architecture for the solution

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# 5. Conclusions and Recommendations

## 5.1

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