

## VI Kitchen Assistant

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Marat (Matt) Sadykov n9312706  
Customer receipt number: 22705821

Supervised by:  
Dr. Brown Ross

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# 1 Executive Summary

TOBE WRITEN I BELIEVE

## 2 Introduction

### 2a. Project Overview

This research project is focused on constructing training environment to perform some basic tasks. In particular, it establish kitchen environment, which will be supervised by Virtual Intelligent (VI). Using set of motion detection tools and Kinect camera tool on the top of area, VI will be able to track persons movements, provide cooking advice and follow up environment state to inform any sort of danger, which may require user attention. This tool is aimed for people with different disabilities, in order to train, independently from other guardians.

Virtual assistant was given a name *Evka - Enhanced Virtual Kitchen Assistant* <sup>1</sup>. Her name can be translated as Eva, which will be used in majority of cases. Using a hand trackers, tool markers, property or scanners and area content, she will be able decide the best possible way to cook menu, track user activities in order not to harm anyone and track the state of cooking process with level of heat, time and user actions.

At current stage Eva is able to communicate with her voice using "voice asset". Her responses are generated based on user actions. Original idea was to develop Question-Answer Virtual Intelligent environment. However, after going through limitation of the project, users ability and current level of technologies, idea was postponed to better times.

As a result, Eva is able to use Unity Engine Kitchen environment around, which were marked with a tag depending on, which type of tool it belongs. Her dialogues stored in a tree hierarchy and changes depending on user actions. In the mean time, player has the ability to manipulate with object using controllers, represented as mouse and keyboard.

### 2b. Report Aim

Report is aimed to describe what limits can be overcome using game engine. It will present training idea and how easily constructed and adaptive. In the world, where Artificial Intelligence started to take place, this research may prove useful to other similar goals.

As a result, it will contain achieved demonstration and some basic manipulation. In addition, an API document will be generated and, applied to Methodology part.

## 3 Background research

### 3a. Problems and Solutions

The foundation for research was established by supervisor of the project, based on his article [1] about Embed of VR content in life training. It highlighted several concerns, which will be difficult to overcome and suggested several solution. One which closely related to correct research are followed:

1. People with intellectual disabilities finding use of keyboard and mouse harder than using joysticks. Based on P. J. Standen [2] research data, it will be logical to conclude that interaction problem must be solved within virtual world, rather than persons' abilities.
2. Virtual training environment must be processed with guides. However according to Jen K.Y. Wu [3] research data people not always react on messages or warnings around them. Use of simple Graphical User Interface (GUI) must be limited as much as possible, due to its' ineffectiveness. However, some research on people with disabilities highlighted that person may be very precise with following instructions or commands if it's given by a person.
3. Environment itself may cause learning challenges. Even for person without any difficulties, it is usually a bit complicated to switch between virtual world to real. Some of skills practised on simulator, are not always easily achieved in practice. As an example may be a dangerous driving test for first time drivers. That is why driving

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<sup>1</sup>from a Czech language - Eva

instructors are used as a guiders in both situations. With their support person may overcome fear and learning skills along side precaution instincts.

Based on such limitation, solution was yet closer than anyone can think. First and the most complicated one - controllers. There are two approaches, first is Virtual Reality itself. Modern VR glasses requires wearing a helmet with two VR controllers. This way, hands will be processed and displayed in virtual reality like their own. This way will require some training with VR, but it less limited than keyboard & mouse and give person freedom of view and hand movements. Second approach is Augmented Reality. It will require specially established kitchen area with several sensors around and modified VR glasses. Now, person will be in the familiar area, but VI will be able to recognise objects around, draw video projection on the glasses and modify with own images, highlighting any other information. With this approach, persons view is free from any controllers; tools like knife, spoon, water bottle or saucepan are tracked by sensors around. Both solutions are similar to each other with own pros and cons. The goal is to develop universal solution.

Second problem is the idea of VI who watches over environment, it also must act as adviser or like people used to say a virtual friend. The whole reason for VI having a body, voice, personality is a part of training program. Person must learn to trust that VI, so that words and tasks will make a sense for person. If people with disabilities have problems with focusing their attention on something particular, then VI person may help to overcome this dis-balance and enhance his abilities. This approach is much more complicated than it sounds, in order to create believable behaviour will take much higher computational efforts. Therefore, research focused on creating close demonstration.

**Third problem is something unclear from human part of view. This will be hardly hardware problem, than personal abilities. To create an environment which will suit every persons need based on his attitudes will go far ahead modern years, from physical and physiological point of view. Currently, idea was focused on some particular group of people, which were trained under certain program and may achieve same goals.**

### 3b. **\*\*Current achivements**

There are several companies in Australia, who already perform similar technological actions. Endeavour Fondation, doctors . Multicap.

Backgroud experiance with **Multicap** company showed that robotics may become solution to brake difference between healthy and people with disabilities. They robot an humanoid robot with ability to talk, listen and use gestures to act as human. This robot was supposed to teach children with autism through some basics tasks. He was encoraging person to act with his voice and gestures to play some sort of games. Children were more than interesting to such unusual company. Robot **burned** their interest in new technologies.

Experience with multicap touch that children are more attractive to robots...Experience with multicap touch that performing basic not complicated tasks, which are easily repeatable, are easier to learn. Level of complicanse can be compared house cleaning and learning dance moves.

Endeva research results

Use results of [4] as prove good resulting possibility.

Those are difficulties, which current project is aimed to overcome and provide possible solution and establish ground for other modifications.

### 3c. **\*Development approach**

Starting point from a design point of view can be considered a Video Games. In the most popular gaming Library called Steam (make reference later), developers created a Job simulation, one of them is actual cooking in drawed kitchen. However, this game is focused only for entertainment', and hardly can be taken as training program. Second one is more beautiful from design point of view, but difficult for persons with intelectual disabilities. (Potion game or whatever magic thing was it).

Game drawbacks

1. GUI environment
2. useless assistant
3. Unrealistic level design
4. Environment does not react on player action ...

This project aimed to progress this idea and bring it as close to reality as possible.

## 4 Methodology

1. Establish Unity on Home Windows Machine. Google drive used as source control. - Unity 2017.2.0f3 - DONE
2. Use Unity Asset Store to establish sort of kitchen environment. Kitchen asset and creation kit. MCS Female for body. RT-Voice PRO. Meximio animation. - DONE
3. Draw VI model and place in the kitchen. - DONE
4. Build one work flow hierarchy with Evka's feedback. **Camera view track** - DONE
5. Build an easy interactions with enum states as lift pull and collisions. - NOT an EASY
  - Knife - Lift, Pull, Cut. Safe state, Danger State. - DONE
  - Kitchen plate - Cooled, Heating, Hot. Safe state, Danger State. - DONE
  - Pan/Pot - Empty, filled. Cooled, Hot. - DONE
  - Spoon - Cooking Tool. - DONE
  - Glass/Plate/Shell/Fridge - Storage. - DONE (Partially)
6. Give player the hands - keyboard/mouse. - ONE IS ENOUGH
7. Set Cooking ingredients. - DONE
  - Vegetables - Whole, Cutted. Dirty, Clean. Old, Fresh. - DONE
  - Meat - whole, cutted, mean. Frozen, normal. - DEMO
  - Rice - Dry, Cleaned. Empty/ Full. - ???
  - Pasta - Empty/ Full. - DONE
  - Potatoes - Dry, Cleaned. Empty/ Full. - NOPE
  - Oil - Filled, Empty. - DONE
  - Butter/Salt/Paper/Seasons - Yes or Null. - NOPE
8. Set Up Avatar restraints. I.e Do not allow take knife from working area, do not put pasta into empty Pot. ... - DONE

### 4a. \*Development Environment

GEARS\*\*\*

Entire designing work will be performed using Unity Game Engine. Those tools allow build realistic environment, which in future may be transformed to any supported hardware, including VR. Work will be performed on Object-Oriented C# language. Unity has own Assets Store, which contains some presets and others programmers work. In project such as this, it may become the most handy tool.

### 4b. User Manipulators

Surrounding manipulation was meant to go through several different implementing processes.

At current stage, our First Person Player is supported with one hand as a mouse manipulator. They were used for testing purposes and will be reimplemented to work out with more difficult controllers.

Next, it should have been transferred to the controllers use. Instead of having mouse or knife, person will have VR joystick, which will represent his hands. ...

**ADD AS FUTURE WORK.** At final product, there will be no reasons adding controllers to persons hand, instead cameras or Kinect tool will track objects around and their movements. Players must have augmented reality set in order to see an avatar, if necessary and all other warning, visual and audio.

#### 4c. Tools in the worlds

Using kitchen assets from the store, Figure 4.1 below represents resulted area. Avatar on the middle is an assistant, which will guide player through cooking process.



*Figure 4.1: Kitchen environment*

In order to create a living representation of the world, all materials were split to different categories. Tools - knives, spoons, and all cooking related. Ingredients - vegetables, meals, coffee, sugar, salt. Sources - Cups, Saucepans, Plates, Stoves. Their functionality follows same as in real world.

This approach was chosen not only for simple process logic. It can be used for a teaching purposes, to show patients how to act with different kinds of objects.

*Seazing all activities were removed. Theyrequire carefull logic approach.*

In terms of the tools, they exist independently and EvKa watches over their state during entire process. They have to be at particular area, can not be dropped and never must face to a person direction. Using a motion tracker those warning can be re-enabled. Currently, she just watch if it was dropped or not, and returns to origin location.

Ingredients are the same as a tools, excepted that they can change their state during cooking process. They can be washed, cut, fried, frozen. Currently only few of those straits implemented. Depending on complexity of the tasks, these may be enabled. To unfreeze meat, time calculates based on conditions around, vegetable can be washed after collision with water source.

Sources are content for ingredients. Those are final stages for making food. After combining all ingredients, it calculates or sets time for cooking. After, Evka just monitors conditions and provides reminder in the cooking process.

Those are basic tasks which person expect to do around kitchen.

RTVoive capable of using Windows Mac voice and MarryTTS - adaptive served voice. Allows change sharpens, type and speed of voice acting, if necessary

#### 4d. Evka

In order to attract person attention and keep his mind occupied, Evka received a human body, which acts as a support adviser around kitchen. Her abilities extend at entire area, however as a person she located at place, which is view, but

does not affect process around. She also acts as Audio Source, as basic interaction abilities like talking, greeting and idle sitting. Her skills as a person can be extended, depending how living she must be, right now she capable only to track persons view and call for his attention, he gets distracted.

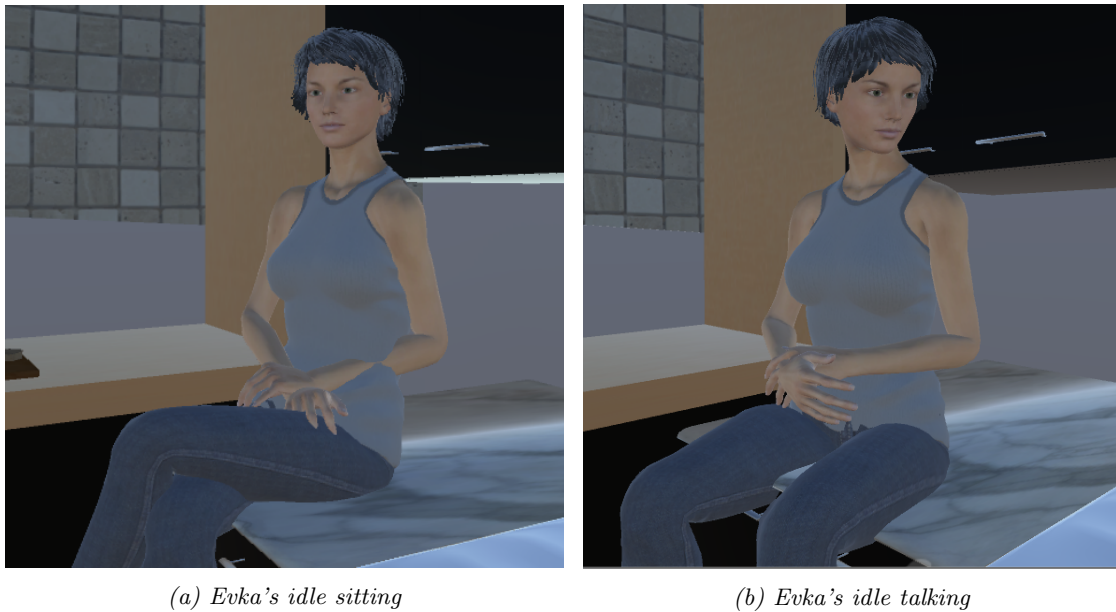


Figure 4.2: *Evka*

Currently, her voice is product of inbuilt Windows or Mac Voices, it maybe not emotional, but contains general understanding of the tasks. This approach will make sure that patients are still occupied with cooking process. If not - she will remind him or her.

Eva has a pre-sets of animation, which avatar expected to be performed on Figure 4.3. Process of installing them has no difference from any other unity projects. One of the Evka's abilities is to point toward objects around. This function is used in case if person gets lost around. She is able to remind patient to grab something, or use it toward vegetables or saucepan. Waiving was used for simple greeting at the beginning, however it may become useful if person gets lost around Virtual Reality. Moreover, Eva's body used as Audio Source to recreate illusion of real person.

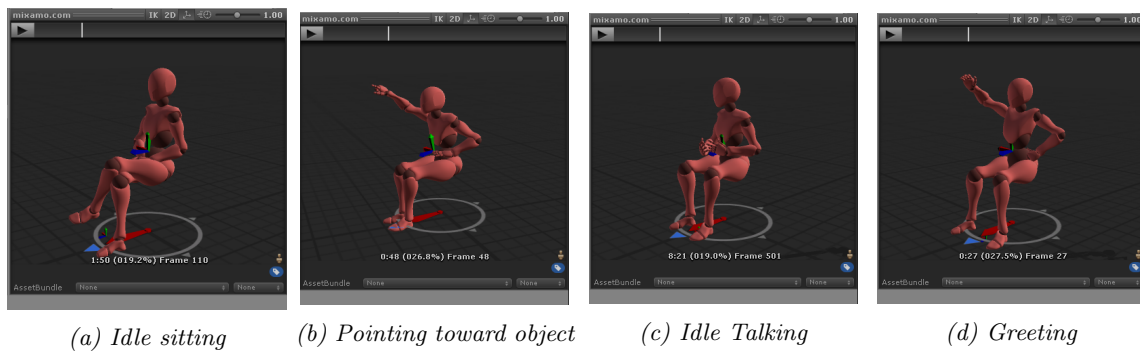
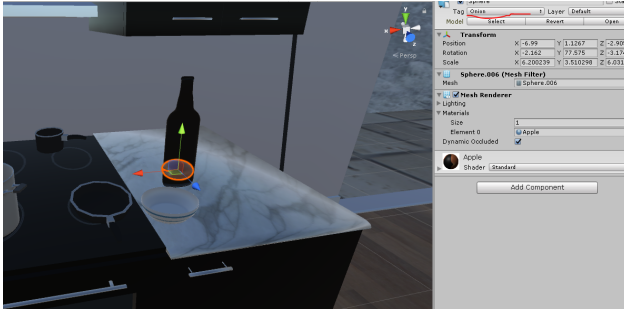


Figure 4.3: *Supported Animation*

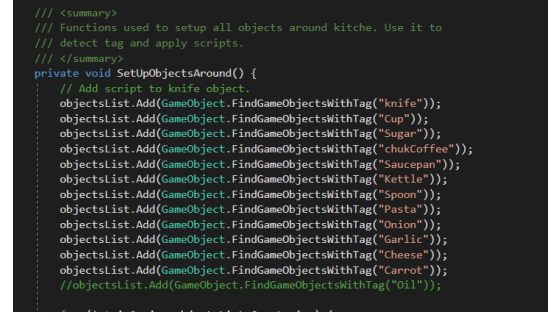
#### 4e. \*Instruction. Use lots of images her

In order to demonstrate the process of easy creation of the new item in the kitchen, following instruction will be provided.

First you have an area. Drop any item which you want to add to surrounding. Manipulate with sizes and add one of pre existed tags, ( *or create a new one if necessary, it may require longer process* ). Figure 4.4 shows added Onion. In order to apply basic manipulation rules, it most be added to the list of objects around, as shown in the code.



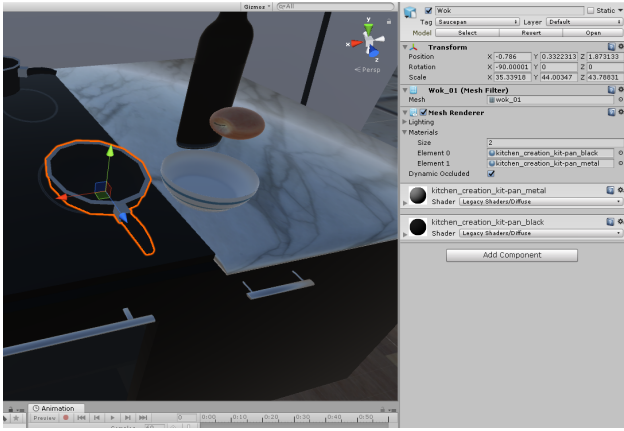
(a) Adding onion



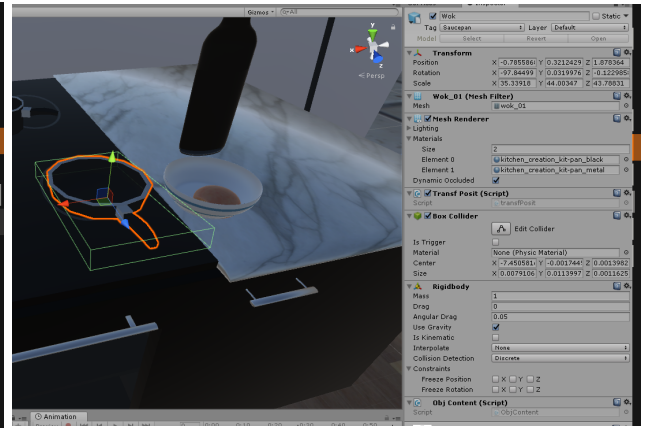
(b) Code for onion

Figure 4.4: Evka

Program will automatically apply basic transform scripts. Take for example we want to add fraying pan an extra tool. After adding it to a world and applying Saucepan's tag, it will be able to store content, which called ingredients for cooking, as all necessary scripts will be applied. Figure 4.5 shows game before and after run.



(a) Evka's idle sitting



(b) Evka's idle talking

Figure 4.5: Evka

Second, create a recipe. Better if it will be stored somewhere accessible. Script named *receipts* contains all current staff possible to cook. As an example, lets create a receipt for stir-fry mince with onion cooked on the olive oil. We assume that pasta already ready and it's not part of receipt. (*such complex receipts will require more manipulation.*) Create and Array List with strings, which contains oil, onion, mince, mixed. Last word will mean that content must be stirring with any object which can do it, like spoon. Time for cooking may be calculated automatically with formulas and room conditions, or can be parsed and presented, it will be showed later.

```
1 using System.Collections.Generic;
2 /// <summary>
3 /// Contains information about all receipts which used in cooking
4 /// </summary>
5 internal class receiptsList {
6     public List<string> receiptCoffe { get {
7         return new List<string> { "water", "coffee", "sugar", "mixed" }; } }
8
9     public List<string> receiptPasta { get {
10        return new List<string> { "Boiled", "pasta" }; } }
11
12    // Newly added receipt
13    public List<string> receiptPastaInNavy { get {
14        return new List<string> { "onion", "oil", "mince", "mixed" }; } }
15 }
```

Sooner or later it will be noticed that mince does not actually exist in the world either. However, this is not a difficult process to perform. Drop any item which you want and add tag mince, same one you used in receipt and perform same manipulation as with onion. Later it will be shown how to add different states of mince. As soon as collision will be performed with pan, object will be considered to be added to container.

The last step is to perform actual cooking process. In the main script, following lines must be added on top of other



processes. How this scripts perform work in written in API, but long story short, it must set what to cook by adding receipt, where cooking must be performed, and what Eva must say then cooking started or there some problems with ingridients. Those lines are optional, it used in case if something else must be performed after cook. Timer accepts condition of the room, plate etc. User is free to set own time.

```
1  stuffToMake.Add(new CookProcc {
2      Ingridients = recLists.recipePastaInNavy,
3      Contents = GetParticularObjects("Saucepan"),
4      SuccessString = "Good Work. Now you have to wait until they ready. I will inform you then time run out",
5      MissingString = "You missing a ",    // Says then something missing from list
6      ExtraString = "Why did you add ",    // Says if something extra added
7      Timer = equations.CalculateBoilingTime(2, 100, 26, 2000, 300)
8  });
```

By default EvKa's dialogues will remainder about remaining time or other actions required, they also can be modified from this call or through timer set up. Basically this is a process of basic cooking. All other processes followed with other instructions. ...

If cooking process requires other manipulation with object like changing a state from solid to messed, it can be performed through modefying a loop with paricular code .....If process requires harder manipulation, then appropriate scripts must be created and added in the same loop as Game Component.

i Knife, pan.. etc.

#### 4f. ?Logic of the world. \*Strips algorithm

In order to understand processes which occurs around, it is better to view them separately. As it's been already discussed, it consist of 3 types of tool. Every tool type monitored by their own independent rules, which can not be broken. This designed to keep user in certain boundaries then he is not in the process of cooking something particular. This approach also allow perform some multitasking operations. All of them are united by one unique cooking process. The example approach, which was mentioned above, showed how logic is united to perform one particular task. However, EvKa can leave focus on user reaction, and focus on the states of objects around. If their condition may cause any danger - certain response will be called.

Response of EvKa's reaction depends on her level of the mood. This approach makes her feel a bit as living being, and as soon as her patience runs out, she will call for assistance from supervisor.

## 5 Conclusion

1. What was achieved? - Environment designed, algorithm adaptive, dialogues created.
2. Portability. - Extract package, prefab..
3. Augemented reality research
4. What has become with Evka

As a result of two months research and development, design wend through several modifications. At the end, resulting product came to VI, which able track state of the objects around, give certain feedback and serve as virtual assistant. Logic behind is easily adaptable and can be reused for other tasks around kitchen. This will totally depend on clients desire and persons abilities.

However, this is not guaranty total independence, but it will a first step to something greater in the future.

## 6 ?Proposal. Do I even need to copy it here?

## 7 Acknowledgements (other's assets)

Virtual environment was created using several different assets form Unity Assets Store. THose are...

kitchen Creation Kit, Kitchen Asset, MORPH3D - Evka's body and Clothes (Cyria), RTVoice

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