

POLITECNICO DI MILANO
Scuola di Ingegneria Industriale e dell'Informazione
Corso di Laurea Magistrale in Computer Science and Engineering
Ingegneria Informatica



GEA
Gioco Educazione Alimentare

Relatore: Prof.ssa Franca GARZOTTO
Correlatore: Dott. Mirko GELSOMINI

Tesi di laurea di:
Federica BLANCO Matr. 875487
Giulia PENNATI Matr. 882962

Anno Accademico 2017–2018

Sommario

In italiano, descrizione NDD, scopo tesi, descrizione tecnologia usata(in breve), nome sistema sviluppato e collaborazione. (circa 1 pagina)

Abstract

Traduzione del sommario.

Ringraziamenti

GENERICO FAMIGLIE PROFESSORESSA CORRELATORE PERSONE IN
PARTICOLARE (VITO E NICO) ASSOCIAZIONI AMICI E COLLEGHI

Federica e Giulia

Contents

Introduction	1
0.1 Food problems and their impact on childhood	1
0.2 Virtual Reality	3
0.3 NDD	5
0.4 GEA	5
0.4.1 Thesi Structure	5
0.4.2 Origin of the name	6
1 State of the art	7
1.1 Modern technologies for NDD people	7
1.2 VR	7
1.3 Touch screen	7
1.4 Google Chromecast	7
1.5 Projects about food education	7
2 Target groups, Needs and Requirements	9
2.1 Requirements elicitation	9
2.2 Onlus varie	9
2.3 Main target groups	9
2.4 Context and need addressed	9
2.5 Constraints	9
2.6 Goals	9
2.7 Requirements	9
3 Design	11
3.1 General approach	11
3.2 Descrizione singole parti	11
3.3 Scenarios	11
3.4 UX	11
3.4.1 Site maps	11
3.4.2 Pages	11
3.4.3 Use cases	11

4	Implementation	13
4.1	Tools	13
4.2	Hardware Architecture	13
4.3	Software Architecture	13
5	Content issues	15
6	Evaluation	17
7	Value proposition	19
8	Future work	21
	Bibliography	23
A	First appendix - User manual	25
B	Second appendix - Questionar	27

List of Figures

1	Childhood obesity diagram	2
2	Allergy hospital discharges barplot	3
3	Telepresence influencing variables	4
4	Virtual Reality taxonomy	4
5	Stereoscopic image and the correspondent 3D image	5
6	Virtual Reality investments sectors	5

List of Tables

Introduction

0.1 Food problems and their impact on childhood

One of the main problems of modern society is the one related to nutrition. Nutrition has changed a lot in history thanks to the industrial development that allowed the massive production of foods that in the past were produced only by hand (and with high costs) and thanks also to scientific progresses that allowed the discovery of food conservation and their elaboration to obtain new kinds of food that are more suitable to our need. Montignac [7] also identifies other causes that brings the concept of "nutrition" to assume the current meaning, for example the habits evolution and the female emancipation that has changed the ancient vision of women as "landladies" and that has promoted the progression of the "ready meals" industry and therefore of pre-cooked and packaged meals that today are consumed increasingly. However, the main phenomenon that has taken place in our era is the one related to the globalization and standardization of destabilized north american eating habits that has promoted the global growth of fast-food, indicated by WHO (World Health Organization) as a "pandemic" since 1997 given its extraordinary expansion that carried also a lot of other problems.

Childhood obesity is surely one of the clearest examples of these diet's changes of the new millennium. According to a seminar held by CB Ebbeling, DB Pawlak and DS Ludwig [4] childhood obesity is a phenomenon that has had a great increase in all the world in the last twenty years, as we can see from this diagram.

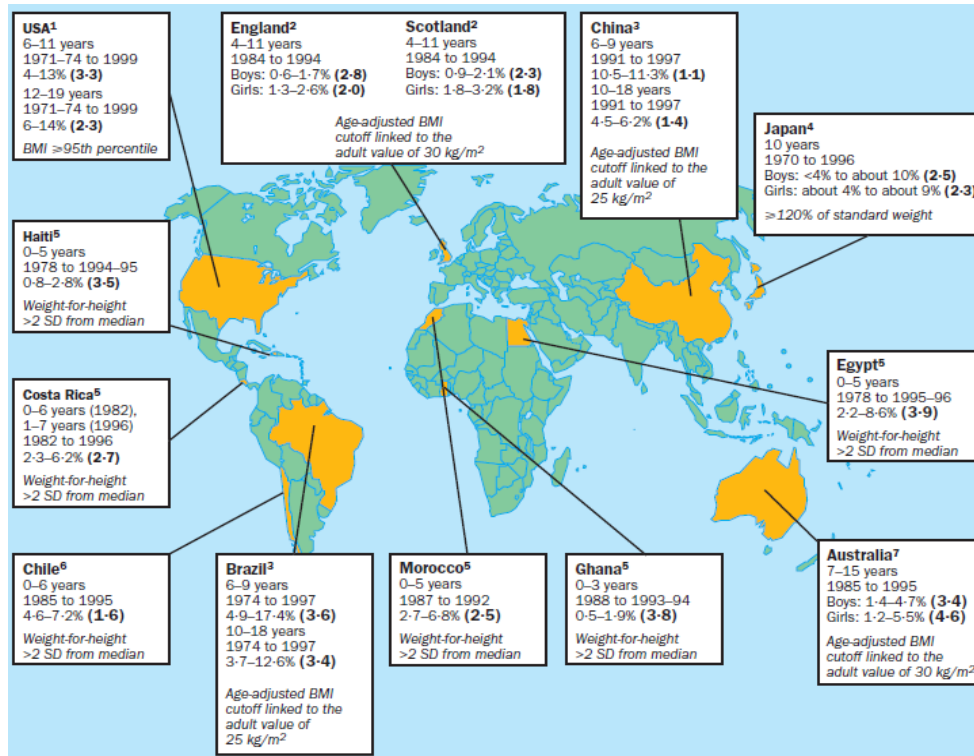


Figure 1: Childhood obesity diagram

Historically, a fat child was seen as healthy because he was likely to survive better to illnesses and infections; however, excessive fatness has become one of the most diffused health problem in children. The three experts have underlined how the problem is most common in developed and industrialized nations in which diet has changed radically favouring foods containing saturated and trans fat and with high glycaemic index, typical of fast-food in which also bigger portions are served. Moreover, these foods are also poor of fibre, micronutrients and antioxidants that the body needs for a correct functioning of metabolism. The excessive consuming of these foods brings the child to have health problems such as heart diseases, vascular disorders, hypertension, chronic inflammations and diabete of type 2, illness that in the past was not present in teenagers, but that now has had a rapid spread.

Another important problem that affects the food safety of children is represented by allergies. According to the data collected by AM Branum and SL Lukacs [1] it is possible to observe an increasing in cases of all kinds of food allergies including milk, eggs, peanuts, tree nuts, fish, shellfish, soy and wheat of around the 18 per cent on individuals under the age of 18 from the 1997 onwards in US (but we have reasons to believe that this can also be found in all the industrialized world). Reactions to these foods may vary from small diseases to anaphylactic shock that, in severe cases, could lead to death. The researches have also underlined how, in the same period

analyzed previously, there was also an increasing of hospital discharges (clearly after an hospitalisation) due to allergic reactions as we can see from this barplot.

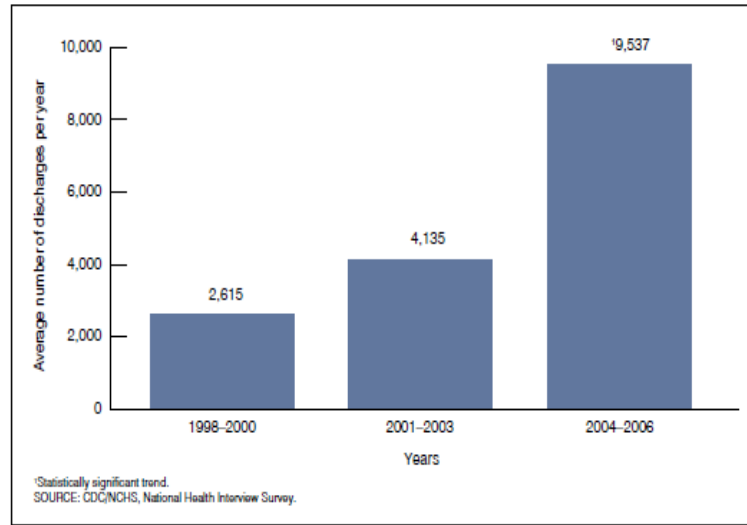


Figure 2: Allergy hospital discharges barplot

All these problems that have been reinforced in recent years, lead us to think that it is necessary to support nutrition education and to make it a fundamental thing during childhood and adolescence, in order to empower everyone to a correct care of their health.

0.2 Virtual Reality

"Virtual Reality is electronic simulations of environments experienced via head mounted eye goggles and wired clothing enabling the end user to interact in realistic three-dimensional situations." (Coates, 1992)

We can define it using two variables: vividness, richness of an environments representation, and interactivity, extend to which a user can modify form and content of a mediated environment. The vividness is composed by sensory breadth, which refers to the number of sensory dimensions simultaneously presented, and sensory depth, which refers to the resolution within each of these perceptual channels; the interactivity instead is formed by speed, which refers to the rate at which input can be assimilated into the mediated environment, range, which refers to the number of possibilities for action at any given time and mapping, which refers to the ability of a system to map its controls to changes in the mediated environment in a natural and predictable manner. [8] All of them, combined together, influence the telepresence that refers to a set of technologies which allow a user to feel as if he was present at a place different from his true location. So a "virtual reality" is defined as a real or simulated environment in which a perceiver experiences telepresence. [9]

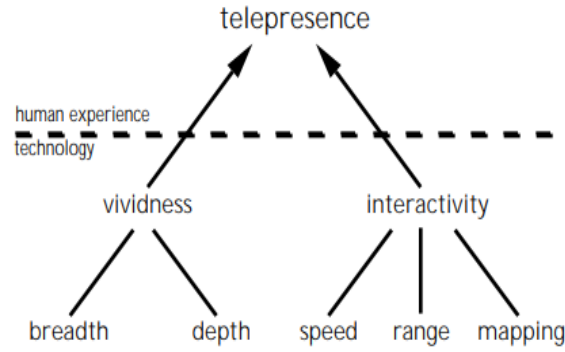


Figure 3: Telepresence influencing variables

We focus our project on Wearable Immersive Virtual Reality (WIVR). Immersive is the term that refers to the degree to which a virtual environment submerges the perceptual system of the user in computer-generated stimuli. The more the system captivates the sense and blocks out stimuli from the physical world the more the system is considered immersive. [6] Wearable indicates that the virtual environment is displayed in specialized small screen: we use a binocular head mounted displays (HMD) which allows to reach a fully immersive experience as we can see from this taxonomy by Muhanna [2].

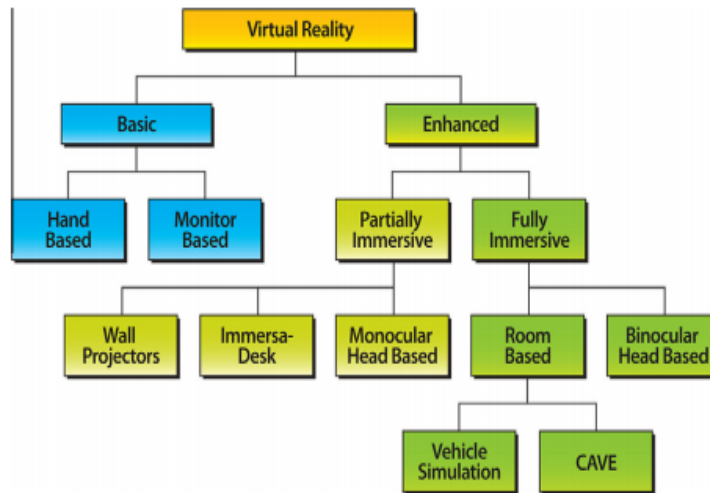


Figure 4: Virtual Reality taxonomy

The HMD "trick" our brain using the principle of stereoscopic vision to simulate the perception of depth and to create 3D images and spaces, the VR has to generate two different images one for each eyes. The lenses of the visor augments the eyes in such a way we can converge the two scenes to obtain only one but that seems to be

in the 3 dimensions space. Finally it can track the head movement so when we move it the space updates.



Figure 5: Stereoscopic image and the correspondent 3D image

Nowadays HMD are very popular and the costs are in a very big range from a cheap one, like Google Cardboard [3], to a more expensive one, like Samsung Gear VR [10], so the VR is for everyone. The VR is also used in a lot of different sectors as we can see in the following graph representing the investments in the 2015 taken from Digi-Capital [5].

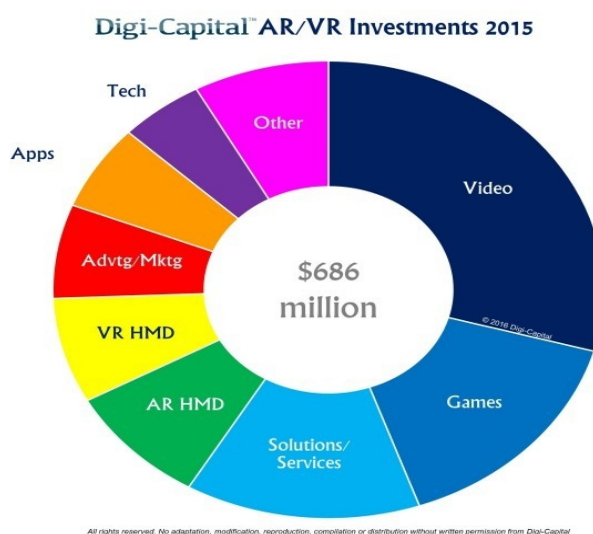


Figure 6: Virtual Reality investments sectors

0.3 NDD

0.4 GEA

Descrizione ed evoluzione di GEA

0.4.1 Thesi Structure

The thesis is organized as follows:

Chapter 2 (State of the art) In this section we show all the technologies for Virtual Reality, explaining how they work and their relation with NDD people. We present also an instrument very useful for therapist that allow to replicate the smartphone's screen, Google Chromecast, and the touchscreen evolution. Finally we describe the projects already developed about food education.

Chapter 3 (Target groups, needs and requirements) Here we present the on-lus we collaborate with to better understand the NDD problematic and to evaluate our application. Next we talk about our context, need and goals, all the requirements we have and all the constraints are imposed to us.

Chapter 4 (Design) In this chapter we put an high-level description of our project and every application's part is described in details. After that we put possible scenarios and the user experience.

Chapter 5 (Implementation) We present all the tools used to build up our application and the hardware and software architecture description.

Chapter 6 (Content issues) POSSIBILI PROBLEMATICHE SE PRESENTI

Chapter 7 (Evaluation) We show the evaluation sessions describing all the results, feedbacks and opinions we collect to improve our project.

Chapter 8 (Value proposition) We discuss about the effects that our application has on the target group but also on therapists and families. PAPER SE CELA FAMO.

Chapter 9 (Future work) Possible future projects that comes from this one.

0.4.2 Origin of the name

We decide to give the name GEA to our application because of two reasons. The first one is that Gea, in the greek mythology, was the personification of the Earth, the mother of all life so she is also the symbol of the nature that recalls the nutrition's topic. The second motivation is that in Italian Gea is the acronym of "Gioco Educazione Alimentare", which translated is "Food Education Game", in this way in the title there is the objective's explanation.

LOGOOOOO

Chapter 1

State of the art

- 1.1 Modern technologies for NDD people
- 1.2 VR
- 1.3 Touch screen
- 1.4 Google Chromecast
- 1.5 Projects about food education

Chapter 2

Target groups, Needs and Requirements

2.1 Requirements elicitation

2.2 Onlus varie

2.3 Main target groups

2.4 Context and need addressed

2.5 Constraints

2.6 Goals

2.7 Requirements

elencati

Chapter 3

Design

3.1 General approach

3.2 Descrizione singole parti

3.3 Scenarios

3.4 UX

3.4.1 Site maps

3.4.2 Pages

3.4.3 Use cases

activity diagram

Chapter 4

Implementation

4.1 Tools

4.2 Hardware Architecture

4.3 Software Architecture

Chapter 5

Content issues

Problems and solutions con tabella pro e contro.

Chapter 6

Evaluation

Fasi varie strutturate con: objectives, participants, test setup, introduction to the test, test procedure, feedback, test results and conclusions.

Chapter 7

Value proposition

Chapter 8

Future work

Bibliography

- [1] SL Lukacs AM Branum. Food allergy among us children: trends in prevalence and hospitalizations. *NCHS Data Brief*, (10), 2008.
- [2] Muhanna A.Muhanna. *Virtual reality and the CAVE: Taxonomy, interaction challenges and research directions.*, volume 27, pages 344–361. Journal of King Saud University - Computer and Information Sciences, July 2015.
- [3] Google Cardboard. <https://www.google.com/intl/en/get/cardboard/>.
- [4] DS Ludwig CB Ebbeling, DB Pawlak. *Childhood obesity: public-health crisis, common sense cure.*, volume 360, pages 473–482. The Lancet, August 2002.
- [5] Digi-Capital. <https://www.digi-capital.com/news/2016/01/arvr-investment-in-2015-breaks-out-near-700-million/#.VznX0RWLRE4>.
- [6] B. Delaney F. Biocca. *Communication in the age of virtual reality*. 1995.
- [7] Michel Montignac. *La storia dell'alimentazione dell'uomo*.
- [8] Stefan Seipel. An introduction into virtual reality environments. https://www.it.uu.se/edu/course/homepage/igs/ht06/lect/F1_igs_intro_vr.pdf, 1997.
- [9] Jonathan Steuer. *Defining Virtual Reality: Dimensions Determining Telepresence*. 1993.
- [10] Samsung Gear VR. <https://www.samsung.com/global/galaxy/gear-vr/>.

Appendix A

First appendix - User manual

Appendix B

Second appendix - Questionar

