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KnowRISK

Know your city, Reduce seISmic risK through non-structural elements

Prevention and preparedness projects in civil protection and marine pollution. Prevention Priorities

Deliverable Report

Deliverable E4 – Educational tools for risk reduction

Task E – Tools and strategies of risk communication and learning

Deliverable/Task Leader: INGV/INGV

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Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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LIST OF SYMBOLS AND ABBREVIATIONS

AR	= Augmented Reality
POI	= Point of Interest
3D	= three dimensions
APP	= Application
SDK	= Software Development Kit
CSS	= Cascading style sheet

1. DESCRIPTION OF THE DELIVERABLE

1.1 INTRODUCTION

Seismic risk reduction calls for preparedness not only in terms of countermeasures for building construction and reinforcement. It also requires effective scientific outreach activity to convey useful information to people living in regions prone to earthquakes. This aspect is particularly crucial especially when one takes into account non-structural damage inside and outside the buildings in case of non-destructive earthquakes. Indeed, even a small (low-magnitude) earthquake can lead to high costs for the lack of simple (and cheap) solutions that can prevent non-structural damage.

KnowRISK focuses in sub-Task E4 on advanced tools that can promote efficient dissemination of information to schools and the public. Based on our know-how [Sorge et al., 2013] acquired during a previous European project (UPSTRAT-MAFA - Urban disaster prevention strategies using macroseismic field and fault sources - http://upstrat-mafa.ov.ingv.it/UPStrat/), the INGV working team at Catania has developed a new dissemination format in order to communicate the importance of *Knowing the Risk* due to non-structural damage caused by earthquakes. The basic idea was to develop *"talking posters"*, explaining with Augmented Reality features how to be safe in case of earthquake and providing useful information to increase the common awareness on seismic risk [Falsaperla and Reitano, 2016].

In addition KnowRISK implemented a card game that was essentially based on the Practical Guide.

1.2 AUGMENTED REALITY

Unlike reality, which is the state of things as they actually exist [Wikipedia, 2016], Augmented Reality (AR) enriches the real world with digital information by using a cutting-edge technology. It operates overlaying real-time images (coming from a video camera) with virtual elements, such as 3D models, pictures, and videos. Virtual and multimedia elements are superimposed using different information layers in order to obtain a unique view for users' eyes. Elements that can "increase" reality can be viewed through a mobile device, such as a smartphone or through a tablet with a video camera. POI (point of interest) can also be added to the real world using other on-board sensors, such as the internal GPS device, nowadays present in every new-generation mobile phone. The process to create AR is based on the real-time capture of images from any device (typically on-board cameras) and GPS location; then, a software generates layers full of virtual items, such as image contents, queries to a web page, etc. AR also gathers a wide variety of user's experiences. It is possible to distinguish three main categories of AR tools [Augment Web Site, 2016]:

"Augmented Reality 3D viewers, like Augment, allow to place life-size 3D models in your environment with or without the use of trackers. Augmented Reality browsers enrich your camera feed with contextual information. For example, you can point your smartphone at a building to display its history or estimated value. Augmented Reality games create immersive gaming experiences, like shooting games with zombies walking in your own bedroom!"

The best results of AR require the development of a complex software (generally one or more APPs – an APP is typically a small, specialized program downloaded onto mobile devices), working with image processing and computer graphics. Most of the useful data can be directly derived from real-time and/or offline images. For example, imagine a user who needs to know how many restaurants are located around his/her own actual position. In this example, the results of the search with AR mark the GPS coordinates of restaurants extracted from internal data to the user's device (Fig. 1).

Fig. 1 A typical example of AR from Nokia/Microsoft App (HERE City Lens) using internal GPS and compass.

Throughout the process of graphics overlay, images can be used to add or even to remove/hide parts of the real environment. Optical and video AR technologies are both under development (a tablet screen vs optical glasses) to better increase user's perception of reality.

1.3 SOFTWARE: THE WIKITUDE EXPERIENCE

Developed by an Austrian company (Wikitude GmbH), Wikitude was the first AR distributed application worldwide.

Wikitude [2016; http://www.wikitude.com/products/studio/] is an impressive tool to create AR software. It can visualize data of the real environment through a camera and includes an Image Recognition Tool and a 3D model. Furthermore, Wikitude distributes a social Framework called Wikitude Studio, with which developers have the opportunity to make exciting AR experiences.

1.4 PROTOTYPE OF THE “TALKING POSTER”

Our KnowRISK APP was built using the Wikitude Software Development Kit (SDK) for Android. This exploits web technology (i.e., HTML, JavaScript, CSS) and allows the developer to write software within a multi-platform system. Architect elements are the basic building blocks; Application Programming Interface (API) are also available to connect the APP to the most used operating systems (Windows, Linux, Android, etc). The interaction between the Wikitude SDK and the KnowRISK APP was obtained by adding a special “view” called ARchitectView user interface to our platform. We divided our poster into three different sections, containing target (static) images (Fig. 2).

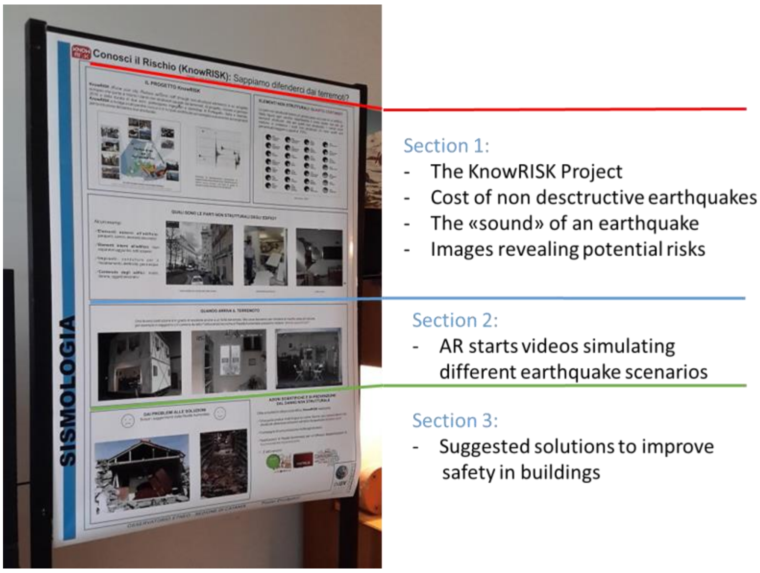

Fig. 2 Scientific content layout of the “talking poster” of KnowRISK.

These target images were the "virtual button" to activate our AR application. It is worth noting that AR might apply to all senses, not just sight. For example, our APP includes sounds: a target image associated with a seismogram (at the top of our poster, in Section 1, see Fig. 2) allowed visitors to experience the "sound" of an earthquake by using a proper frequency shift.

1.5 PILOT AREA MT. ETNA

We tested our KnowRISK prototype of talking poster during "ScienzAperta", an open-door, scientific, outreach event that INGV organizes yearly for schools and the public [Falsaperla et al., 2016]. We prepared an "animated" exhibit according to the working scheme of Fig. 3.

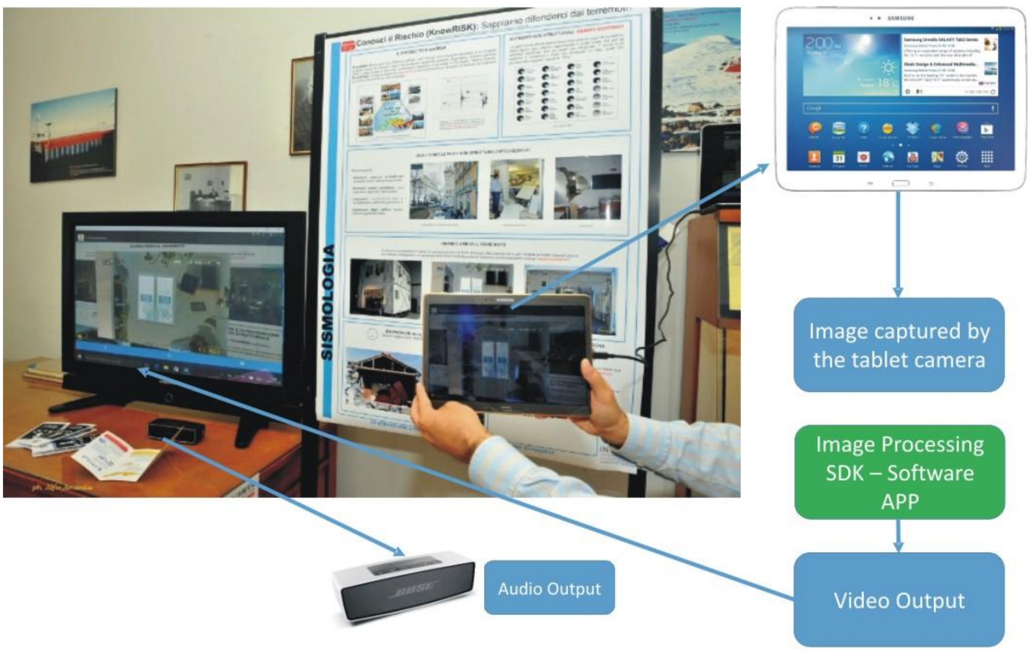

Fig. 3 "Talking poster" of the KnowRISK exhibit based on our working scheme of Augmented Reality.

The exhibit was open to the visitors at INGV Catania during the 5-day-long event, from 16 to 20 May 2016. Part of the images of the poster in Fig. 2 were frames of videos depicting visible effects inside and outside a building anchored to a shaking table. Our APP allowed visitors to see what happens during a shaking table test, which simulates different scenarios based on non-destructive earthquakes. When a target image came into focus, the software recognized it and played the video on a tablet (Fig. 3). As the groups of visitors were large (between 12 and 18 people – Fig. 4), we decided to transfer the data from the tablet to a bigger monitor to improve the vision (Figs. 3-4).

Fig.4 Presentation of the KnowRISK exhibit during "ScienzAperta" 2016 at Catania.

An audio-surround device was also associated with the videos to make effects more impressive (Fig. 3). Eventually, the poster itself "suggested" solutions to improve safety in buildings, by switching various images on the screen; for example, before and after the application of simple solutions to fix a problem (e.g., fall of objects, heavy furniture).

1.6 A GAME TO ENGAGE PUBLIC: DO IT RIGHT: BE SAFER!

This is a board game based on the KnowRISK Practical Guide (PG). The 36 cards inlcude solutions suggested in the PG, instructions, 4 avatars characters (a seismologist, an engeeneer, a civil protection officer, a fireman) and 4 cards with icons suggesting the money and expertise needed to apply the solutions. The solutions are grouped according to the Move-Protect-Secure-Retrofit concept.

The game prototype was tested during the KnowRISK final conference. It was than compelemented including for cards that present wrong solutions (Fig. xxx) and succefully used during ScienzAperta 2018 (Fig. xx).

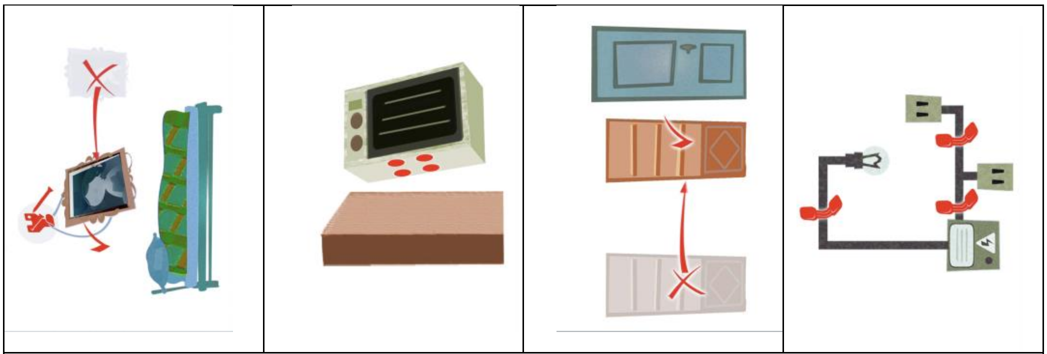

Fig.5 The four cards presenting wrong solutions.

Fig.6 Students at ScienzAperta in Milan 2018 winning a run with the card game.

1.7 A SMALL SHAKE TABLE TO ENGAGE PUBLIC

The knowRISK team members implemented two differet type of shake tables:

a shake-box and a small shake-table. The shake-box is usefull for schools as it can be easily implemented by students, has a low cost and trigger a great interest of teachers. The small shake-table can use a real accelerogram and reproduce the shaking on mechano-made structures as well as on buidling contents. It was implemendet and used during ScienzAperta in Milan in March 2018 (Fig.7)

Fig.7 Shake table's demonstration at ScienzAperta, Milan 2018.

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