Children Road Safety Training
with Augmented Reality (AR) [Demo]

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ABSTRACT

Children killed or seriously injured through road accidents can be avoided through an appropriate safety training. Through play and engagement children learn and understand hazards at i.e. railway stations, bus stops, crossings, school zones, train stations, footpaths, or while cycling. We developed a rapid prototype of an *Augmented Reality (AR)* safety training proof-of-concept demonstrator for a scaled real-world model of dangerous road hazards. Two scenarios have been picked to give children the possibility to apply, and acquire knowledge of road safety: 1. handling emergency situations and informing authorities; 2. correct behavior at a bus stop on arrival/departure of a bus. In this paper we discuss our design approach, outline the technical implementation of the system, and give a brief overview of our lessons learned.

KEYWORDS

Augmented Reality (AR), child road safety, Virtual Reality (VR), safety training, pay, engagement, traffic safety, road safety.

1 INTRODUCTION

It's common knowledge, that children are the most vulnerable pedestrians, cyclists, or vehicle passengers in road traffic. The World Health Organization (WHO) estimates that 30% of injury deaths of the 0-19 years old is due to traffic hazards, accounting for 2% of deaths globally. Dependent on country and region, this translates to 5-20 fatalities per 100.000 children [1]. In 2015, the average fatality rate across Australia was 5.1/100.000 for all age groups, where approx. 15% was related to children (21/100.000), in sum 20% of the total population [2]. These numbers illustrate the importance of training children at young age in traffic safety. While they "understand the danger but have little idea what to look for, and what to ignore" [3][4]. Therefore, it's important to develop a training environment, where children can be trained in hazardous situations – spotting dangers, and eventually avoiding fatal situations.

Using latest technologies, in particular AR enables the simulation of real-life hazardous traffic situations. Children are exposed to potential threatening situations and train how to react correctly. They learn to spot harmful situations, and how to respond. AR gives a realistic experience if combined with a scaled real-world model of train stations, bus stops, schools, or traffic crossings. Figure 1 illustrates the scaled real-world model of the

Constable Care Child Safety Foundation (CCCSF) safety school, which has been opened in Perth, Western Australia [5]. The model is fully equipped with AR markers, WiFi, and interactive features, and can be considered as the world's first installation of this kind.

Figure 1: Scaled real-world model built by the Constable Care Child Safety Foundation in Perth, WA, Australia equipped with dangerous road hazards (i.e. pedestrian crossing, bus-stop) [5].

Through a cooperation between Curtin University's VisMedia Lab [6] and the CCCSF a student group has been working on creating design concepts, prototypes, and scenarios for the project as part of work integrated learning activities. To illustrate the potential of AR, we have been focusing on the development of an interactive scenario for the AR marker on the backside of the bus, which is illustrated in Figure 2. The goal of this paper is to:

1. introduce the design approach and technical challenges of the demonstrator;
2. describe the AR demonstration based on the marker on the bus (the creation of a minimal viable prototype); and
3. give a very brief overview of educational and training aspects of the demonstrator.

2 RELATED WORKS

Much work has been devoted to investigate AR (especially e.g. [7]) and smart, locative, and ubiquitous service systems

(especially e.g. [8] and [9]). However, research in converging child safety training and technologies such as AR and intelligent systems is rather scarce.

Figure 2: **AR marker on the scaled real-world model of a bus placed in the overall child safety training center.**

3 AR DEMONSTRATOR

The demonstrator was developed following a *Design Thinking* [10], [11] methodology, where a broad variety of ideas is generated at the beginning, and the best are selected for prototyping. After meetings with the clients, it was decided to develop a scenario for the AR tracker on the backside of the bus. Table 1 gives an overview of the results of the brainstorming sessions, and the scenario that we have been aiming at. The principle idea was to train children to call emergency services, when an emergency event occurs. In our case, a bus was on fire, and children have to react correctly.

Table 1. Description of the Learning Event: 'Bus on Fire'.

Learning Intensions	Training children the right process to call emergency services
Learning Experience	Students should learn how to react in unforeseen emergency situations correctly, and memorize the number of the emergency services
Description	A bus is on fire, and children are provided with different choices how to react in this particular situation
Key Messages	Emergency services don't know your location, think before acting wrongly; what do emergency services typically ask; the number is not 911
Quiz/Questioner	• Dialing the correct emergency number • Emergency services know your location (Y/N) • What is the best to do in an emergency?
Information for Teachers	Information materials about emergency services, how to dial numbers correctly, how to react correctly

The implementation is running on Android OS, and was developed in Unity with the Vuforia software package. A tablet PC and its camera was used for placing the graphical content on the marker on the backside of the bus. The overall flow of the application is illustrated in Figure 3, and a few screenshots of the application are presented in Figure 4.
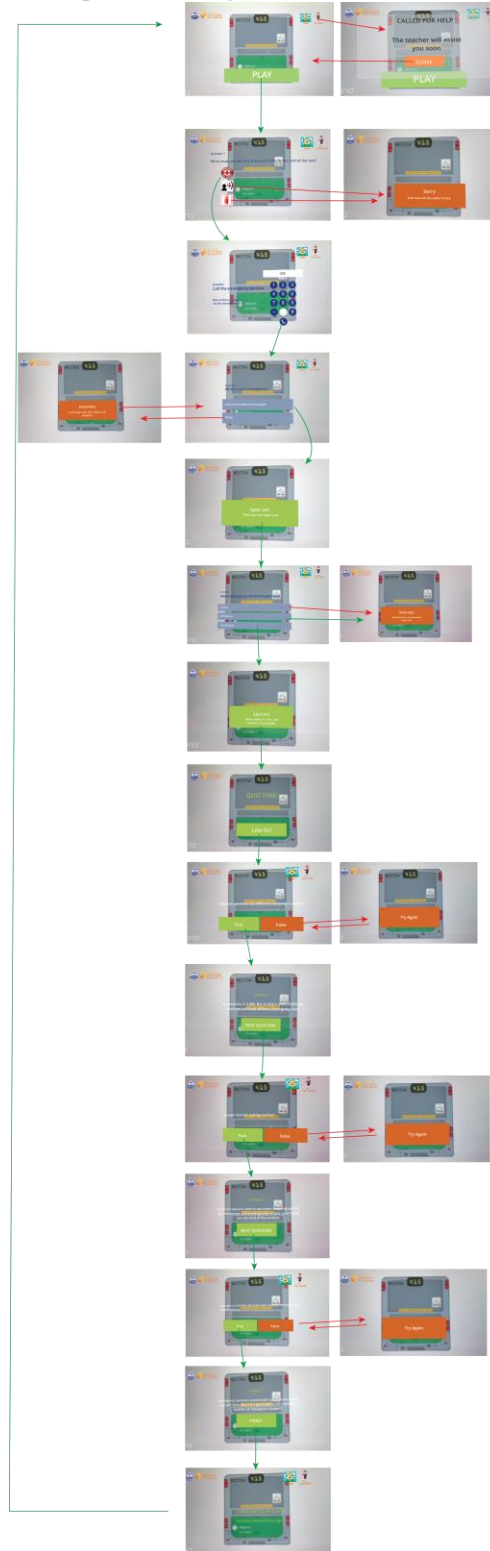

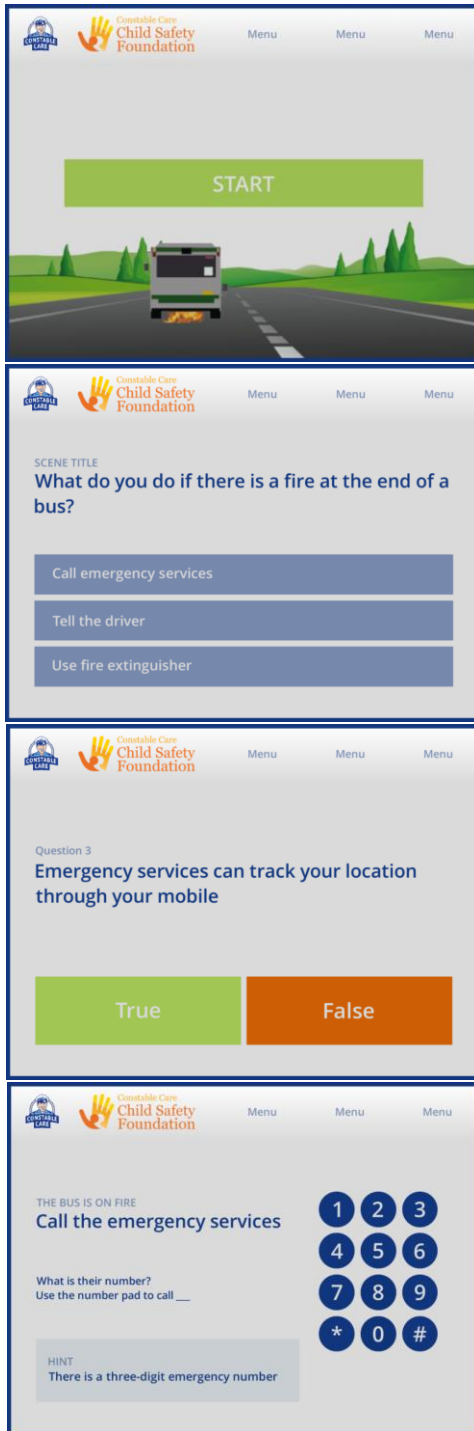**Figure 3:** **Flow diagram of the demonstration.**

Figure 4: Screenshots of the AR system.

4   CONCLUSIONS

We strongly believe that this application will help children to understand the danger, but also train them in different ways how they can cope with the situation – e.g. to call emergency services,

and ignore certain other non-viable alternatives. Through AR the learning experience is intensified, and real-life situations can be trained, especially when using a world scaled model of typical traffic hazards. Our future work will focus on the development of more scenarios, and data analytics to understand training performance and improve the learning experience.

Acknowledgements

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