

## 2 | BUS SIMULATOR IN VIRTUAL REALITY FOR YOUNG ADULTS WITH INTELLECTUAL DISABILITIES

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### ABSTRACT

Virtual Reality (VR) can be used to simulate training scenarios that may be too dangerous or too expensive to be recreated in real life. Currently, people with intellectual disability (ID) train complex everyday situations in the real world under the strict supervision of one (or more) accompanying person until they become autonomous. However, these real-life simulations present risks, can be complicated to set up, and mobilizing the involved people requires time and money. This paper presents a VR simulator conceived with the help of social educators and intended for teenagers and young adults with a light or moderate ID. The simulation enables the users to train different conditions in the scenario of a public transport bus in an urban area.

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### KEYWORDS

Virtual reality; Intellectual disability; Simulation.



### Virtual Reality

- Safe, low-cost, controlled training



### Reality

- Validation of knowledge transfer





### CONTEXT

Self-determination has been defined as “the attitudes and abilities necessary to act as the primary causal agent in one’s life and make choices and decisions regarding one’s life quality free from undue external influence or interference” [1].

Young adults with intellectual disabilities (ID) often have the ability to personally control the events in their life. However, this capacity being often underestimated, they can engage in self-determined behavior processes when given the opportunity and the means to choose. Therefore, it is very important to continue supporting young people with ID into acquiring the skills for a better independence. Practically, this means to let them test certain situations autonomously and safely (e.g. taking the bus, how to behave if they miss the right stop, manage conversations with strangers, etc.).

### TARGETED ISSUES

Currently, in order to allow young people with ID to train in situations of interest, several people must participate to build the desired conditions and provide constant supervision. The required cost and time prevent it sometimes. However, new technologies, such as Virtual Reality (VR), can be used to simulate certain conditions safely, in a structured, repeatable and controlled way.

This project aims to create a VR-based system that would offer learning situations to adolescents or young adults with a light to moderate intellectual disability, in order to let them face these situations without risk before practicing them in real life.

10 With the help of a social educator, we designed and developed in this project a bus scenario in which the user can simulate the three following conditions:

- › Get on the right bus
- › Get off at the right stop
- › Interact with a stranger

*This project aims to create a system based on VR that would offer learning situations to adolescents or young adults with a light or moderate intellectual disability [...].*



### PROPOSED SOLUTION

The solution we propose in this paper is a VR simulator with which three scenarios can be played, one per condition presented at the previous section’s end. These three scenarios can be played independently or together to make a bigger, more comprehensive scenario. The played scenario depends on the skills that we want to train with a specific user (however, for our target population it is usually better to train one skill at a time). The three scenarios take place in an urban environment: in the “Get on the right bus” scenario, the user waits for his bus at a bus stop. Several buses arrive one after the other within a customizable time interval and the user has to get on the right one.

In the “Get off at the right stop” scenario, the user sits in the bus and she/he has to select the right stop. In the “Interact with a stranger” scenario, a human avatar (male or female) approaches the user asking him/her to follow him/her for a coffee, a cigarette or something else. If the user refuses, the stranger insists with an increasing degree of insistence.

### RELEVANT INNOVATION

VR has been previously used to train children and adults with various types of IDs in different scenarios such as street-crossing [2] or route learning [3, 4]. Many studies were performed even before that realistic VR became widely accessible. In 2005, a review [5] showed VR efficiency to promote skills for independent



living in scenarios such as shopping, cooking, and road safety. With the notable exception of people with autistic spectrum disorders, the studies also showed that there was a transfer from what they learned in VR to reality. The current technology may improve these results by providing better immersion and interaction possibilities and by providing new ways to monitor the user’s behaviors in VR.

In our project, in order to have a realistic simulation of the stranger’s avatar in the “Interact with a stranger” scenario, we combined motion capture (performed using inertial sensors), automatic facial animation (based on recorded dialogs) and manual animation to fine-tune facial expression. In addition, to track the user’s point of view, we use eye tracking integrated in the VR headset. This will be used in a following analysis to study the differences between the target population and a control group and hopefully provide guidelines for better training practice.

The project has been developed by an interdisciplinary team composed of engineers and social educators in order to handle the target population needs in the best way possible.

### PROJECT OUTCOMES & RESULTS

This project main result is a functional prototype that can be used to train people with ID in everyday situations. This prototype allows playing the three defined scenarios.

In the “Get on the right bus” scenario, the user is instructed to get on board of a particular bus (identified by its number and the destination) and can select the right bus by simply going near the bus door and clicking on the button to open the door with the controller.

In the “Get off at the right stop” scenario, the user sits in the bus waiting for the right stop. Since people belonging to the target population could have reading disabilities, similarly to what happens in real buses, the next stop served by the bus is presented to the user in a multimodal way: a voice announcing the stop name and a writing on a panel above the driver’s place. The city environment is spread with landmarks such as colorful houses, signs of common supermarket chains or post offices. In this way, the user can train to retain or pay attention to particular landmarks.

The “Interact with a stranger” scenario is the most challenging of the three and is currently an early stage prototype. The character animation is fluid and realistic but the overall result needs to be thoroughly tested with users in order to reduce the possible bias coming from the uncanny valley (you can see the impact of bad illumination in Fig. 2).



## CONCLUSION

Getting on the right bus, get off at the right stop, and interact with a “dangerous” stranger are three scenarios often recreated in real life by social educators to train young people with ID to become more independent and develop self-determination.

In this paper, we present our work in which we recreated these scenarios in VR proposing a low-cost, easily reproducible and safe training environment.

## PERSPECTIVES & NEEDS

In the short term, the next goal is to perform the first acceptability tests with users belonging to the target population. In a longer-term view, we would like to assess the learning transfer from VR to reality. Finally, we plan to add physiological sensors to the system so as to monitor elements such as stress and fear.

## REFERENCES

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