Cobes
The clean, safe and hospitable metro

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Abstract

In this paper, we describe the concept Cobes: a neural network-based dynamic lighting system for a metro environment, which aims at increasing the cleanliness and thereby enhancing the perceived safety of the carriages. We describe the target group of our concept, the implemented technology and the dynamic light behaviour.

1 Introduction

The Cobes concept aims at enhancing the hospitality of the metro environment. Customer research by GVB, the metro operator in Amsterdam, has shown that the metro is the least appreciated mean of urban public transport, despite the fact that it is the most efficient and most punctual. This highlights an interesting application for a design concept that enhances the perceived quality of the metro, and the experience of its travellers.

2 Cobes

The Cobes system aims for a clean and pleasant metro environment. By analyzing human movement patterns through a neural network, the Cobes system can determine irregularities in the metro, such as litter or damaged seats. Travellers are unconsciously guided to pleasant places within the metro carriage by the dynamic lighting system.

3 Target group

The system mainly focuses on commuters, people who use the metro on an (almost) daily basis. Typically, commuters travel individually, during rush hour. Other characteristics are boredom, routine, social isolation and indifference towards their environment.

We chose to enhance the information given to the user to make appropriate seating choices based on cleanliness and peacefulness in the train. We do not try to change their rituals during travel, often resulting in unwanted results, but instead give a long term engaging solution only visible upon entry of the metro.

4 Technology

One of our observations in the metro in Amsterdam was that people tend to distribute themselves (physically) in the metro carriages according to fixed patterns. These patterns can be observed in other types of public transport as well, in particular the types with similar internal design, such as trains, busses and trams. In general, one could say that people tend to sit as far as possible from other people. This only

applies to individual carriages however, since the middle part of a metro train is always more crowded than the front and rear end.

Based on the above observation of the patterns being disturbed by irregularities in the metro environment, we propose the following concept: By analyzing the physical presence of passengers in the metro over time with a neural network, the network will be able to identify and locate possible irregularities in the metro.

Identifying dirty or broken chairs is not just a matter of looking at the occupation of the chairs. For example, outside rush hour, the window seats facing towards the rear of the metro are hardly used. However, if the chairs around them are often in use, this probably means that there is nothing wrong with these chairs. Therefore, the full pattern of an entire metro carriage needs to be taken into account in order to draw a proper conclusion. This is exactly one of the strengths of a neural network, which makes it very feasible for this situation.

Practically the neural network receives input from all the occupied seats between stations, when the train is riding. The network receives a string of numbers, where the location of the number in the string is the number of the chair, and the value of the chair is the number of stations it is occupied. After two or three stations a pattern evolves that the neural network recognizes against a trained background. This knowledge is then used as input for the lighting algorithm which makes dirty or broken chairs darker during stops to take them out of focus.

5 Dynamic light behaviour

The images below show the different types of light behaviour: When the metro train is riding, all light intensities are equal (figure 1). When the metro train stops, littered places are darkened, and empty seats are illuminated slightly more (figure 2). When a seat is in use, the light also is also slightly dimmed, but only during stops (figure 3).

Figure 1

Figure 2

Figure 3

6 Discussion

The demo as presented at BNAIC 2009 is a first version. It mainly serves as a demonstrator, showing the combined strengths of artificial intelligence and designed, dynamic lighting behaviour in a “daily life-“ setting. The current concept leaves many opportunities for improvement, especially regarding the intelligence (neural network) and the lighting behaviour. The lighting behaviour is currently being further designed and evaluated within the Department of Industrial Design.

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