INTERACTIVE GREEN STREET ENHANCEMENT USING LIGHT DEPENDENT SENSORS AND ACTUATORS

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ABSTRACT

We propose and demonstrate a design of an interactive green street facility using light dependent sensors and actuators for enhancing the social cohesion of people. We show that electronics and green design can have positive effect on social interaction in a neighbourhood by a design example, called the "Prachtpaal", for the Bennekel district in the city of Eindhoven, the Netherlands. By adding unique green designs in the district, the atmosphere and living quality of a neighbourhood can be greatly improved. With the implementation of light dependent sensors and colourful lights, the growth of the green plants is indicated so that people are stimulated in a more responsible way to take care of the plants. We show by experimental demonstration that the implementation of light dependent sensors and actuators for interactive design achieves stimulating effects on the inhabitants, which enhances social cohesion and activities in the district.

Key words: interactive environments; sensors and actuators

1. INTRODUCTION

Social cohesion and sustainability of society are important topic for our human beings [1,2]. With the rapid development of technology, sensors and actuators have been applied to interactive design to stimulate more communication between people and enhance the quality of life [3-6].

In this paper, we propose and experimentally demonstrate a design of an interactive green street facility, called the "Prachtpaal", using light dependent sensors and actuators for Bennekel district in the city of Eindhoven, the Netherlands. The interactive model shows that the green facility increases the social cohesion of the neighbourhood. Furthermore, the facility is easily maintained by the residents and enhances engagement by provoking participation. Section 2 describes the design process. Section 3 shows the design and implementation of sensors and actuators. Section 4 discusses the social effects. Section 5 draws conclusions.

2. DESIGN PROCESS

Before we start explaining the electronics and the effects which they can achieve, we briefly explain the design process. The design process started with an extended field and scientific research. During this research, the social structure of the Bennekel [7] was investigated in order to state an identity. This leaded to the following results:

Bennekel Oost has about 3200 inhabitants and a total of 1400 houses. The average age is 34 years, which is lower than the average age of Eindhoven. Generally, people older than 55 are under rated in the neighbourhood. Besides that, there are relatively a lot of students who live in Bennekel-Oost.

Fig. 1 shows the ethnic statistics in Bennekel. We can see from the figure that in Bennekel-Oost 42% of the inhabitants has non-Dutch cultural background. Another remarkable fact of Bennekel-Oost is the high mobility. Almost one-third of all inhabitants stay less than 5 years in Eindhoven.

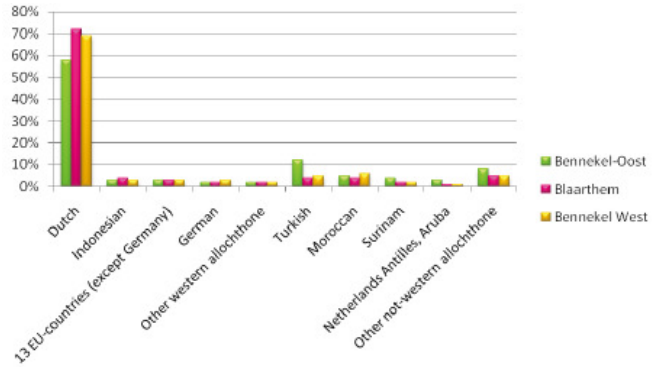

Fig . 1 Ethnic Statistics in Bennekel-Oost

The percentage of unemployed people in the Bennekel is relatively high regarding to the other parts of Eindhoven. One out of ten 15-64 years old, is subscribed at the CWI. Fig. 2 shows that out of these people, 75% had either no education or only finished elementary school, lbo or mavo.

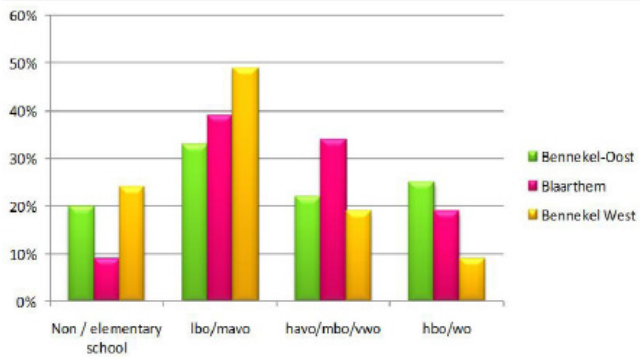

Fig. 2 Statistics Educational Level Bennekel-Oost

The neighborhood mostly consists out of rent houses. In total, 5% of all houses are student houses. On average these houses have a value of approximately €90.000. An average house in Eindhoven has a value of about €130.000. The situation of the inhabitants of Bennekel-Oost isn't hat positive. They have less money to spend and there health situation is also a lot worse than in other parts of Eindhoven (see Fig. 3). A lot of people (40%) feel lonely and feel the need of more support (16%).

The results of this research leaded to the following requirements for our design:

- The product should improve the identity of the neighbourhood
- The product should obtain human-technology interaction and provoke human-human interaction
- The product should be 'Green' and sustainable.

With these criteria in mind, the "Prachtpaal" eventually comes out of idea generation. The basic idea behind the "Prachtpaal" is to have a big pole in the middle of the street with several organically shaped arms reaching out to the first floor windows. At the end of these arms are flowerboxes attached with different kinds of Ivy in it. People can optionally choose their own kind of ivy to personalize their box a bit more. Along with the growth of the ivy there will be several lights on the bottom side of the arms that switch from white to green light with implementing light dependent sensors and actuators, so the green lights "grow" together with the plants.

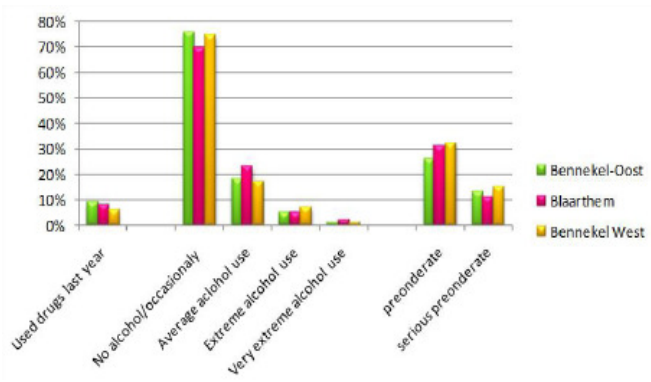

Fig. 3 Statistics of Health Issues

3. SENSORS AND ACTUATORS

As mentioned earlier in this paper, the "Prachtpaal" model has light dependent sensors and actuators implemented which encourage people to take care of their plants, and feel responsible for the ambiance of their street.

Fig. 4 shows the electronics circuit used in our experimental model for implementing light dependent sensors and color lights. The electronics consist of a voltage divider, a transistor, a relay, two switches and two light emission diodes (LEDs). The voltage divider consists of a light dependent resistor (LDR) and a 1.5 KΩ resistor. The voltage divider is connected to a second electronic circuit via a BC550 NPN transistor.

The light dependent resistors are implemented on top of the arms of the model. When the plant and ivy grow and cover the LDR, the resistance over the LDR increases, and therefore the voltage potential over the transistor decreases. When the potential over the transistor decreases below ± 0.7 V, the transistor closes and the relay will switch from the white LED to the green LED. As the light emitting diodes are implemented on the bottom side of the arms, the growth of the plants will be visual for the residents at night. The precision of the synchronization of the growth of the plants and the color of the LEDs is dependent on the amount of circuits described above which are implemented into the object.

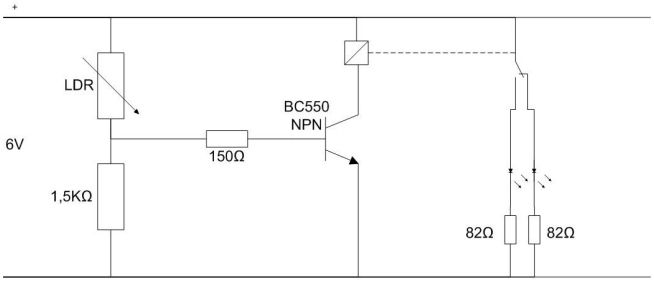

Fig. 4 Electronics circuit for implementing light dependent sensors and color lights.

4. SOCIAL EFFECTS

One of the most important goals of the project was to stimulate the residents to take responsibility for the ambience of their neighbourhood, so they could feel proud again. During our field research we quickly noticed that a compelling approach in our design was not going to work. Therefore we looked for possibilities which we could implement in our design to motivate the residents to become enthusiastic about the "Prachtpaal" as shown in Fig. 5, and in this way persuade them into taking care of the plants and their neighbourhood.

Fig. 5 3-D model of the "Prachtpaal".

We explored the possibilities to create an interaction between the residents and the product with means of sensors and actuators. In the final design we decided the plants as a medium between the interaction of the residents and the product. This resulted into a very subtle human-technology interaction. Because the lights grow along with the plants the emphasis is put on the "growth", which symbolizes the growth of the social engagement of the residents. So, when the user takes good care of his plants the resident have the opportunity to finish the product and improve the life quality of their district.

The "Prachtpaal" is a conceptual design which leaves room for discussion. The electronic circuits described in this paper are used in the demonstration model. In full scale production, a circuit with a more smooth transition between the colour of the light would be appropriated. Furthermore, good and close communication is required with the inhabitants of the streets for the final product. Currently, the city of Eindhoven is working on further developments on the "Prachtpaal".

5. CONCLUSION

We presented an interactive design example, called the "Prachtpaal", for the Bennekel district in the city of Eindhoven, the Netherlands. Circuits with light dependent sensors and actuators have been applied to an interactive facility of constructing green street in the district. We showed that the social interaction and social cohesion of residents in the district are enhanced by the unique green designs with application of sensors and actuators. The experimental model demonstrated that stimulating effects on the inhabitants and quality of life enhancement could be achieved by interactive design with applying sensors and actuators.

6. ACKNOLEDGEMENT

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