Tangible User Interface Design for Lower Limb Disabled Children -
A composite function of toy accompanying children at home

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Abstract: This study describes the requirement of lower limb disabled children. Lower limb disabled children that limit their movement in nowadays environment. Ubiquitous computing concept is more popular now. This research uses tangible user interface to be a toy accompanying children at home, combine ubiquitous computing concept to help them control the electronic equipment so that disable children can earn their lives.

Keywords: Disable; disability; tangible; user interface,children; ubiquitous computing.

1. INTRODUCTION

Children with disabilities that limit their movement are known to develop relatively poor spatial skills. Nowadays, to advance non-hazardous physical environment is more and more important than before. Normal family also needs to improve non-hazardous physical environment.

Lower limbs disabled children stay at home are inconvenient to pick up the phone or control the electric equipments. If we can improve physical environment, we need another way to help Limb disabled children earn their living by themselves.

Ubiquitous computing concept that can help children at home more convenient earn their lives. In latest years, there are many researchers working on developing "tangible user interfaces" for interactive experiences. If children can take a toy they trust with them in anywhere at home, and that toy can let them not only answer the phone but also control the electric equipment, more over, if they fall down and get hurt, this toy can notice parents and hospital. It really helpful for lower limbs disabled children

2. RELATED REVIEWS

Ubiquitous computing encompasses the notion of computing being woven into the backdrop of natural human interaction[11]. People with disabilities often experience difficulties that arise from their interactions with electronic equipment, above and beyond the usual risks. It is often not realized that many everyday products originated as inventions to aid people with disabilities[1].

There are many systems developed for much kind of disabled people, such as people with visual disability or hearing disability. Unfortunately, mainstream commercial system development or interior design tends to ignore the requirement of relevant lower limb disabled children. In order to help address such concerns, interoperability among different media for different disabilities would be a worthy goal [8].

As technologists, we must be much more proactive in understanding the nature of the problems and potential approaches to improving the situation [8]. There is an increasing level of recognition that those needs must be met in the design of interfaces [3,4]. Tangible User Interface [2, 5, 6, 9, 10, 12] is one way to help disable children earn their lives. Designing for exceptional users has much broader significance than is often assumed [1].

3. METHODOLOGY

Environments that can react to children that can improve children develop their ability otherwise children may feel helpless [13]. Every child all has some reaction in their lives. For example, a hog from mother when they crying. We can provide children a toy that can react to them are not very hard. Make a simple reactive world for children not only can stimulate their ability but also can help them realize what they can do and get better experience.

Nowadays children they usually have the habit of relying on others. In this project, the tangible user interface designed that children can carry with them in anytime at anywhere at home. A common creed of human-computer interface designers is "Know the User" [1].

So I interviewed with lower limb disabled children whose ages are from 5-year-old to 10-year-old and their parents really understand what they need. On the positive side, addressing the needs of special populations can result in interfaces that are easier for everyone to use [8].

Then I analyzed these result to obtain what kind of function I need to design into this tangible interface. However, it would require significantly greater

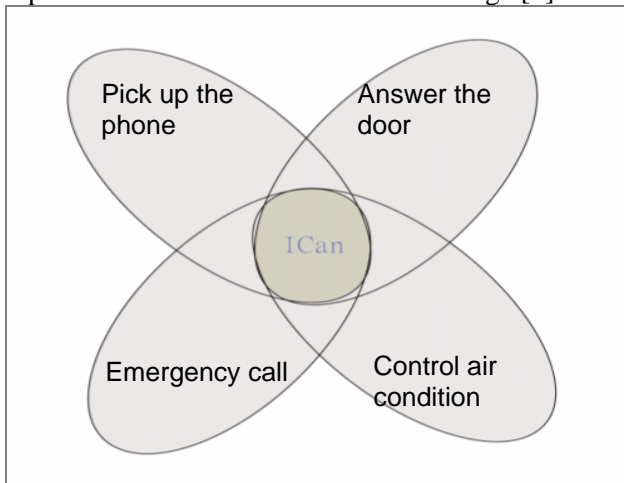attention to interface standards and in some cases represents a formidable technical challenge [8].

Figure 1. 「ICan」 *functions.* 「ICan」 *combine four functions together which are Emergency call, control air condition, answer the phone and door..*

There are four kinds of function I designed into this tangible interface which are pick up telephone, turn on/off the air condition, answer the door, finally is emergency call. Children can use these functions control the electronic equipment at home. Children can carry the 「ICan」 doll to everywhere if they want. They won't worry about how to turn on/off the equipment or afraid they may late for picking up the phone. They can stay at home live like normal children.

4. IMPLEMENTATION

This tangible user interface I named is 「ICan」, means even lower limb disabled children also can do those things that normal children can do. In this project, it needs to setup a server inside the house, and using IO-9624 control module to complete wireless remote control. This device supports the wireless, so in this house the server can receive the signal from everywhere inside this house.

In the 「ICan」 toy, it also need wireless function, and using EP-132B wireless Ethernet translate the signal to the server. The shape of 「ICan」 is like a bear doll, inside has sensor control the signal in its nose, hand, mouth and back. When children press the nose or twist bear hand, it can start the server, which the equipment can cooperate with children.
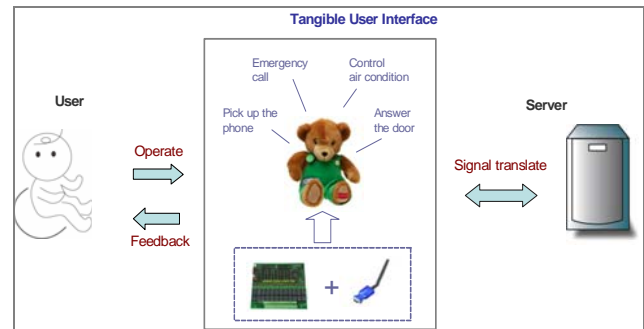

Figure 2. Interactive diagram. User can operate the tangible user interface which has four functions and combine the IO9624 card and EP-132B wireless terminal. The TUI translates the signal to server and the server the response back. Them user can get the feedback from the TUI.

5. A SIMPLE SCENARIO EXAMPLE

Angelly is an 8-year-old girl, she has a bad left lag and not convenient for walk. Today she hold her 「ICan」 doll stay at her room, suddenly, the phone ringing, she press「Ican」doll mouth, the doll start speaking: hey, Angelly, it me, daddy, how about school? Angelly said: it funny; teacher said my picture is very beautiful. And then daddy hangs up the phone. And then Angelly feel a little bit hot, so she press 「ICan」 bear nose once, and then the air condition starting work. Angelly feel today is a really nice day.

6. CONCLUSION

The goal of this research is to help designers understand the requirement of children with disability. Then the designers can using different way to help special group to earn their lives such as tangible user interface combine ubiquitous computing.

As technologists, designers have a responsibility to consider such standards when designers design systems or products or spatial design. In this study, it just combine few functions that are easy for children to use, in the future, it can be extended to more composite function for more people with disability.

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