

Guiding Mild Dementia Elders with Tele-Micro-Controlled- Sensor System.

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Abstract

This paper presents a Tele-micro controlled guidance system for elderly people especially with people who have been affected with Dementia. This system makes that they can walk outdoors with no one and their caregivers can monitor them or guide them from remote site continuously without need of extra help. The goal of this research is to realize a prototype system i.e., a Tele-micro controlled guidance system, which provides easy understanding for elderly users with mild dementia with laser projection connecting elderly people and caregivers effectively via ubiquitous network i.e., from any place.

Introduction

Dementia is the loss of cognitive functioning, which means the loss of the ability to think, remember, or reason, as well as behavioral abilities, to such an extent that it interferes with a person's daily life and activities. Signs and symptoms of dementia result when once-healthy neurons (nerve cells) in the brain stop working, lose connections with other brain cells, and die. While everyone loses some neurons as they age, people with dementia experience far greater loss. Researchers are still trying to understand the underlying disease processes involved in the disorders. Scientists have some theories about mechanisms that may lead to different forms of dementias, but more research is needed to better understand if and how these Mechanisms contribute to the development of dementia.

Memory loss, though common, is not the only sign of dementia. For a person to be considered to have dementia, he or she must meet the following criteria:

- Two or more core mental functions must be impaired. These functions include memory, language skills, visual perception, and the ability to focus and pay attention. These also include cognitive skills such as the ability to reason and solve problems.
- The loss of brain function is severe enough that a person cannot do normal, everyday tasks

In addition, some people with dementia cannot control their emotions. Their personalities may change. Dementia

with Lewy bodies (DLB), one of the more common forms of progressive dementia. Symptoms such as difficulty sleeping, loss of smell, and visual hallucinations often precede movement and other problems by as long as 10 years

Vision:

Some of the most common reasons for vision loss in older people are cataracts, macular degeneration and damage in the vision area of the brain caused by dementia.(Fig.1)

Cataracts are caused by age, disease and certain medications occur when the chemical [makeup](#) of the eye changes and causes the lens of the eye to become cloudy. If damage to the optic nerve or blockages that prevent proper blood flow to the eyes occurs as a result of damage by dementia, the result may be the loss of peripheral or vision, which also increases the risk for bumping into objects, tripping and falling.



Figure 1. How a person with cataract might experience their field of vision.

A loss of cells in the retina is one of the earliest signs of frontotemporal dementia in people with a genetic risk for the disorder — even before any changes appear in their behavior.

While dementia is more common with age (as many as half of all people age 85 or older may have some form of dementia), consider the population of elderly persons 60 years old or older in China and it is estimated to reach 200 million in 2013. Finland and Japan are also facing an

increasingly aging population due to low birth rates and improved life expectancy. It is estimated that by 2050, the percentage of the population of Finland and Japan over the age of 65 will be 27% and 33%, respectively. The number of elderly people who suffer from varying memory impairments is also going to more than double during the next 30 years i.e., increase of a number of the elderly people with dementia increases. Then, the increase of elderly population requires more caregivers inevitably. Therefore, it is considered to be an urgent need to realize safety-supporting system which can give many mild demented elderly persons normal life.

In this research, a challenging point is to find suitable solution of the above problem to support demented elderly people using information and communication technology

II. Safety Navigation System

Figure 2 shows overview of safety navigation system which is a goal of this research. A mobile phone with wireless communication function is an important key in this structure. Mobile communication devices can make connection between clients (elderly users) and servers (remote caregivers) easy anytime through INTERNET. Through this network, it might be possible to realize that a small group of remote caregivers support a big number of elderly people.

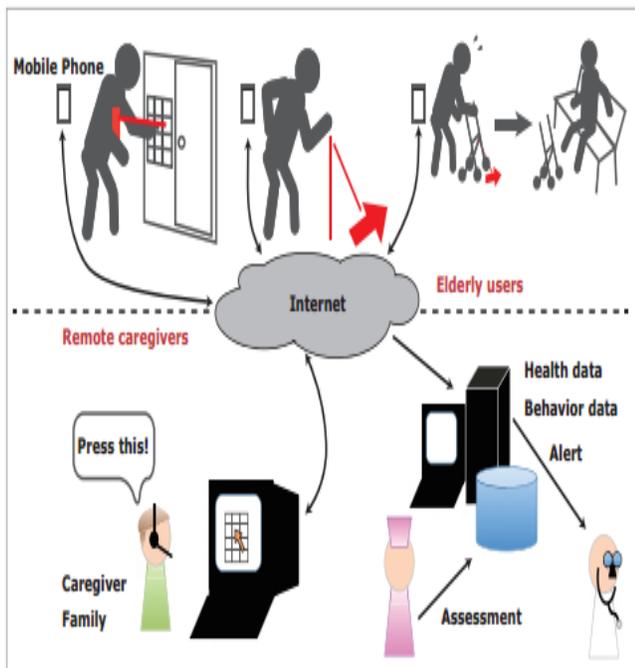


Figure. 2. Safety navigation system overview. Elderly users can get support with laser projection-based indication from remote caregivers.

In such system, this paper describes a novel user interface on a cane /walker which are mobility aids for elderly people

In this paper, the aim is to realize a guidance system onto a mobility aid device that indicates the direction of the arrow, drawn by laser projection onto the ground, to guide the user by remote caregiver. LASER is best to avoid cloudy vision problem as discussed above. The camera or a mobile with front cam, which captures the scene in front of the user, is attached on tip of the cane. The system can detect a risk of fall instead of the blind user and guide them to take another route.

A projection-based visualizing method, which can show various information in the real world, has been developed. How the laser projection method gives guidance information to a user as a remote assistance.

III. System Design

When we question what type of mobility aids is friendly to elderly people. There are a cane, a crutch, a walker, a gait trainer, a wheelchair, and a scooter among them popular were cane/walker majorly used. This proposed system provides a guidance interface, which is connected to remote caregivers via the Internet, to elderly users. The main function is to display the arrow, indicating a direction the user should go to, on the ground directly by laser projection. In order to display visual information by light projection, projectors are often used. However, current projectors are not suitable for use case of outdoor or bright spaces because they don't have enough strong lights to show information to the user. This is the reason why it is decided to use a laser projection method, which can produce stronger light projection, in this study.

A laser pointer can be modified to draw simple figures like an arrow by using slit filters and a lens although in normal use cases it is realized as a spot. The worst demerit of using lasers is the danger it proposes to the eyes. Care must be taken here.

The main components of this system are actuators with a laser module to display an arrow, a mobile device that can connect to the Internet, and a controller as shown in Fig. 3.

Project -Block Diagram

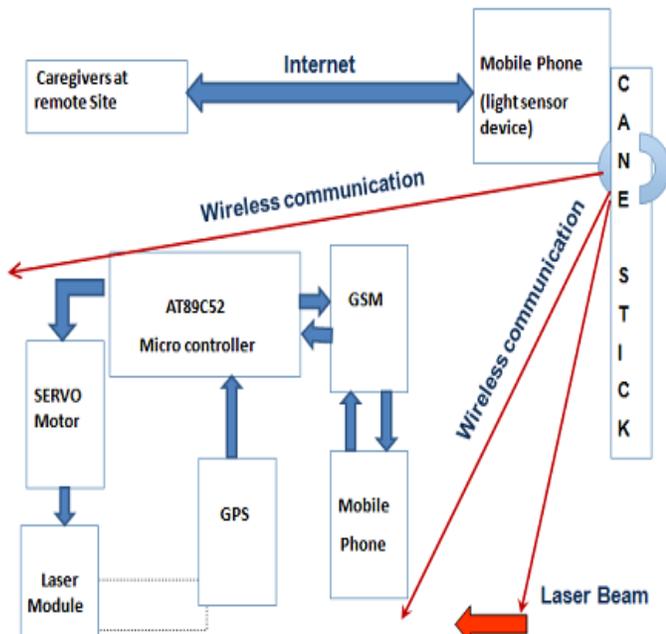


Figure .3. Architecture of the proposed system.

This system has a motor rotation in both forward and backward which is attached to laser module. GPS is also used, on server side system gets the position information of the elderly user from a positioning sensor like GPS so that the remote caregiver can use it to give guide information to the elderly user interactively

Totally a prototype system consisting of a cane /walker, a laser module, D.C.motors, a micro controller, batteries/Adaptor, GSM module, GPS sensor and a computer is as shown in below figure 4 and figure 5.

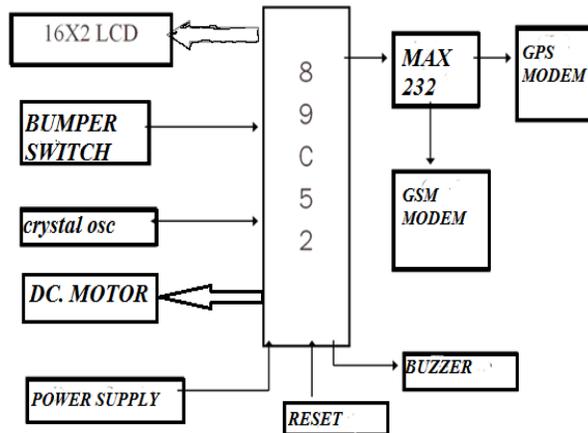


Figure.4 Block Diagram for walker type system

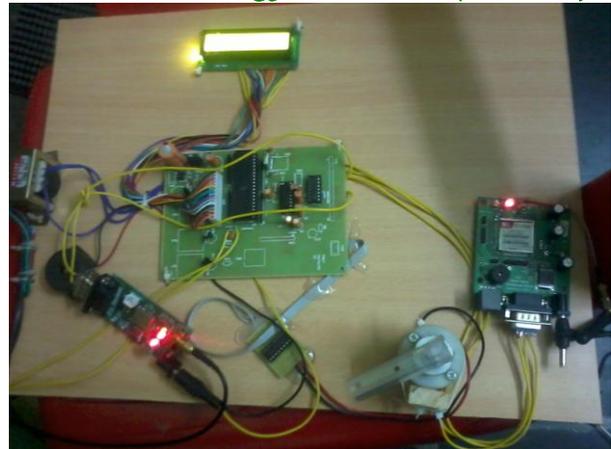


Figure. 5 Original system for walker type.

A micro controller, AT89C52, manages these all sensors and actuators. The position information from GPS sensor used in this prototype is a basic type sensor with less accuracy as we know we don't have permission to access Restricted Service, but the functioning was admirable.

In this prototype system, the laptop or computer is used as remote site server to communicate interactively with the micro controller embedded on the cane. A remote operator can select directions to give it to a tele user as guidance information via mobile phone i.e., through GSM. From GSM the micro controller calculates the angles which the D.C.motors should rotate using the selected direction and a current cane's head direction or in walker. Later microprocessor Calculates Lat. and Long. from GPS and sends it to caretaker via GSM. Buzzer sound is an indication for serial port when our micro controller is linked to GPS. When there is no Buzzer sound then 89C52 is connected to GSM module.

IV User Test Design

The task is to walk from start point, follow the projected arrow, and reach the destination. This path has two corners on the way. To verify the visibility, two parameters are set as conditions to the user. One of them is whether the subject can recognize the shape of the projected arrow.

Another one is to find out what distance between the cane tip and the projected arrow was easiest to see for the user. For this purpose, the prototype system can be implemented to provide different kinds of position to display an arrow for the elderly subject as shown in Fig. 5.

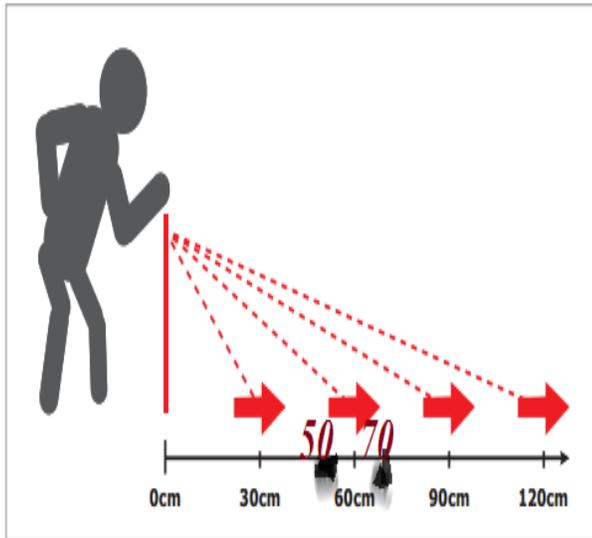


Figure. 5. A variable distance between the cane tip and the projected arrow.

In the base paper, the user test was held at the health care centre (ODL: Oulun Diakonissalaitos) in Oulu. There were six participants whose age range is 89 – 94 years old. The therapist also said that it was not good for the subject if the arrow's position was located at 30cm because their heads were always down and hunched all the time. In a contrasting situation, if the projected position was longer, the subject would straighten up their back. As the result, the best position was not figured out. But a rough range of good position can be obtained by finding centre to extreme positions and by adding +10 and -10 with the centre i.e., results range. Finally for the given extremes 0cm and 120cm range was [50, 70].

For walker there is no need to calculate such a distance, whole system can be kept on walker head with light guidance on the walker.

V. Discussion

The observation gives mainly three things as problem points; the device is shaking, cane might not be suitable for every user, and the system is not robust enough. It would be caused by physical problems from aging. This rough handling swings the cane, so the projected arrow would also swing wildly according to the canes behavior. So instead of cane a walker is used for the prototype.

VI. Conclusion

As one of the important systems under the environment, a tele-micro controlled-sensor guidance system was developed

which can be used directly by real elderly people who has been affected with Dementia.

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