

Application of IoT to improve the life style of differently abled people

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Abstract: A world that anything will be connected to internet is being created, generating an entirely new dynamic network. The Internet of thing (IoT) enables new means of communication between people, things and the environment. By using this technology differently able people can improve their life style to some extent as normal people do. Disability is the consequence of an impairment that may be Physical, Cognitive, Mental, Sensory, Emotional, Developmental or some combination of the above. It may be right from the birth or may develop during a persons life time.

This article analyses the living environment of Sensory and Physically disabled people, then present how IoT can help them to overcome these difficulties.

Keywords: IoT, Disability, Sensory disability, physical disability, RFID.

I. Background

Disability is the consequence of an impairment that may be physical, cognitive, mental, sensory, emotional, developmental, or some combination of these. A disability may be present from birth, or occur during a person's lifetime^[1].

Conditions causing disability are divided by the medical community as

- By inherited (genetically transmitted);
- By congenital, because of mother's infection or other disease during the pregnancy time, embryonic or fetal developmental irregularity condition, or by injury during or soon after birth;
- By acquired, such as conditions caused by illness or injury of unknown origin.

There are different types of disabled people, who are

Physically disabled, Sensory disabled, Mentally disabled, Pervasive disabled, Mental disabled.

In this paper mainly focuses on physical and Sensory (visual & hearing) disabled peoples

1.1 Physical Disability

Physical disability are paralysis (complete or partial), severe weakness, interference with control, missing limbs, and speech impairment. It causes include cerebral palsy, spinal cord injury, traumatic head injury (includes stroke), injuries or diseases resulting in amputation, ALS (Lou Gehrig's Disease) or various diseases such as arthritis etc. etc

Functional Limitations Caused by Physical Disability are Problems faced by individuals with physically disabled include less muscle control, weakness and fatigue, sensing or grasping (due to pain or weakness), difficulty talking, seeing, difficulty reaching things, and difficulty doing complex or compound manipulations (push and turn).

Individuals with spinal cord injuries may be unable to use their limbs and may use mouth sticks for most manipulations and activities.

Individuals with movement impaired may have difficulty with programs which require a response in a specified period of time, especially if it is short. Individuals with damaged movement or who must use a mouth stick or head stick have difficulty in using pointing devices. Programs which need the use of a mouse or pointing devices and have no option for keyboard control of the program present problems. Individuals who can use only one hand or who use ahead stick or mouth stick to operate the keyboard have difficulty pressing two keys at the same time.

1.2 Visual disability

Functional Limitations Caused by Visual Disability are increased sensitivity to glare, viewing the world as through a yellowed lens, no central vision, no peripheral vision, loss of visual acuity or focus, reduced color distinction ability, poor night vision or a general hazing of all vision

Main difficulties Using Computers and Software that they have the greatest problem with information displayed on the screen. Mandatory use of a mouse or other pointing device requiring eye-hand coordination is also a problem. Special programs exist to provide individuals with the capability to enlarge the screen image. There are also programs which allow the individual to have the contents of the screen read audibly. However, application programs sometimes do things in ways that make it difficult or impossible for these special programs to work well or at all. Individuals with low vision may also miss messages which pop up at different points on the screen, since their attention is usually focused on only a small area of the display screen at any time.

Access to Documentation problems are written operating instructions and other documentation may also be inaccessible, if they are not provided an electronic or alternate form, e.g., audio tape or Braille and even then people may have difficulty accessing graph or pictorial information included in documentation. Because many people with visual disability still have some visual ability, many of them can read with the assistance of magnifiers, bright lighting (for printed text), and glare reducers. Many are helped extremely by use of larger lettering, sans-serif typefaces, and high contrast coloring.

Key top strategies for those who are blind or have severe visual impairments include the use of Braille, large raised characters or raised line drawings, Braille and audio tape. Note, however, that Braille is preferred by only about 10% of people who are blind that normally those blind from early in life. Those who use Braille, however, usually have strong preferences for it, especially for shorter documents. Raised lettering must be large and is therefore better for providing simple labels on raised line drawings than for extensive text.

1.3 Hearing Disability

Hearing impairments are among the most pervasive chronic disability. Almost two million are deaf. Functional Limitations Caused by Hearing disabled faced by people with hearing impairment fall into four categories.

- Individuals may not be able to hear auditory information if it is not presented loudly enough as compared to the background noise.
- Individuals who are deaf or who have more severe hearing disability will not receive any information which is presented only in auditory form.
- As voice input becomes more prevalent, it too will present a problem for many deaf individuals.
- Many persons who are deaf communicate primarily through American Sign Language. It should be noted, however, that this is totally different language from English. Thus, deaf people who primarily use American Sign Language may understand English only as a second language and may therefore not be as skilled with English as native speakers.

Individuals who are deaf may sometimes cannot speak, will have difficulty in using telephone support services. Special telecommunication devices for the deaf (TDDs) have been developed, which helps individuals to communicate over the phone using text and a modem. They also support touch-tone input and recorded voice output. The users who access phone-in support services, software companies would need to have TDD-equipped personnel.

There are many kinds of assistive devices available in market which help them for daily living. Assistive devices are devices which help disabled peoples for Mobility, Hearing, Vision.

Physically disabled people use wheelchairs, scooters, walkers, canes, crutches, prosthetic devices, and orthotic devices, mouth stick, hand wand, single switch access, eye tracking technology...etc. Visually disabled people can use walking sticks, Glasses...etc. Hearing disabled people can use hearing aids.

Mentioned devices provide help to disabled people; But they have many some limitations. Technology is developing day by day. One of the emerging technology is Internet of Things which is considered as the future technology of world.

II. Introduction

2.1 Internet of Things (IoT)

Internet of Things (IoT) connect many objects to the Internet. It enables the exchange of data never available before, and brings users the information in a more secure way. Cisco estimates the IoT will consist of 50 billion devices connected to the Internet by 2020. By using the concept of IoT, we can connect devices to internet and they can communicate with each other over internet.

British entrepreneur Kevin Ashton first coined the term in 1999 while working at the Auto-ID Labs (originally called Auto-ID centers - referring to a global network of RFID connected objects). IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices, is expected to usher in automation in nearly all fields, while also enabling advanced applications like Smart Grids, and expanding to the areas such as smart cities^[2].

"Things," in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric alarms in coastal waters, automobiles with built-in sensors, or field operation devices that assist firefighters in search and rescue operations...etc^[3]. These devices collect useful data with the help of various current technologies and then automatically flow the information between other devices.

For example we are wearing jeans without any gender difference. Most of us wear a jeans for 3 to 4 week without any hesitation especially boys. Think one day when jeans informs us "its too stinking, time for washing" by our mobile. That is Internet of Things. Here jeans is connected to our mobile over to internet. A sensor attached to the jeans senses time of washing and inform the user. Some time it may take decisions like the information is also send to any near by washing center if we are busy.

There are many applications of IoT .like,

Manufacturing, Energy Management,Infrastructure management, Medical and Health care, Building and automation, Transportation, Large scale deployment...etc.

While the innovations are becoming recognized, there is potential to make a difference in fields other than business and security, and focus on how the Internet of Things can make a significant impact in health care,esepesily in field of helping disabled people.

With the IoT, it is expected that those with physical limitations will be able to interact, communicate, and possess physical controls through a mobile device, or something similar. According to CMS Wire, developers of such applications would have to spend considerable time on the user interface (UI) to determine usability based on a particular physical limitation. A clunky UI, or one that might require complex gestures, could make usage by some with disabilities difficult. Simple and intuitive UIs would be keys to success in this regard.

The things which can be connect to internet to help the disabled people in any manner comes under this category . A very simple example that exists is in use is the Special Olympics itself. In 2009, the Special Olympics instituted RFID (Radio Frequency Identification) badges to the athletes that included name, biographical information, and medical history. These RFID badges can also be used to track the locations of athletes as they compete but most importantly, to provide medical staff with information should anything befall the athlete^[4].

III. Related Work

The IoT ,the technology of coming world will change and improve the living style of disabled people. They can lead their lives and over come the limitations. IoT will help them in every instant of their life. I have going through different works which play an important role in the life of differently able people.

I would like to introduce the RFID first and then take each case of the differently able people and then the suggested methods of IoT to improve their life style.

3.1 RFID

The Internet of Things requires a few necessary components to enable communication between devices and objects. Objects need to be augmented with an Auto-ID technology, typically an RFID tag, so that the object is uniquely identifiable. Also, an RFID tag allows the object to wirelessly communicate certain types of information, which leads us to another requirement – the ability to monitor data^[5].

The smart object reports data, and the information travels over IP networks to a central database which stores and sorts the data into a human-readable format.

RFID (Radio Frequency Identification) devices are wireless microchips used for tagging objects for automated identification. RFID can communicate wirelessly to objects which embed and need not be line of sight. RFID tag and a sensor to read and measure data. The sensor may capture fluctuations in the surrounding temperature, changes in quantity, or other types of information. objects which also consist a RFID reader which is powerful and contain a small memory. RFID readers will read this information and inform the user through

wireless sensor network and internet^[6]. The RFID tags are divided into three: passive tags, semi passive, and active.

RFID technology is help disabled people in various areas. In case of visually disabled people ,if they want to reach a particular destination or want to purchase from a mall this RFID tags and readers will help them to reach exact location.

3.2 Visually disabled –Differently abled people

Many internet embedded assistive devices are available now and continue developing some technologies are mentioned here for visually hearing physically impaired. There are different number of possible solutions available now. For example, the cane can use a camera and an image processing system to detect if a nearby object is stored in its database, means that it will know how to manipulate it. The cane can also be include sensors for detecting distances and obstacles. There are optical, mechanical, electric, magnetic, and acoustic transducers. I chose the latter category, equip walky with ultrasonic sensors. The reason I opted for an ultrasonic system was that it was readily commercially, and had a cost, which complied with the requirement specification for walky. With the aid of its ultrasonic sensors, walky is able to keep track of the distance between itself and obstacles such as walls. Most distance-measuring ultrasonic systems are based on the time-of-flight method. This method comprises.

The Mowat Sensor is employed with a pulsed ultrasound which is ordained with an analogue vibratory feedback operating over two ranges of distance: up to one meter and a dump to four meters. The vibration frequency is inversely proportional to the distance between the sensor and the object^[7].

The Binaural Sonic Aid (Sonic guide) is a device which furnishes much information about aspects of the person's social environment which lies outside the immediate path of the user. The device is incorporated in the pair of spectacle with two receivers mounted on left and right side, while, the transmitter faces straight piercing the environment via pulsed ultrasound. An obstacle visualized on the left sides detected by the receiver, which, will provide a signal to left ear and similarly for right ear. Hence, allowing the user to determine the direction of obstacle^[8].

Mobile and wireless technologies, and in particular the ones used to locate persons or objects, can be used to realize navigation systems in an intelligent environment. A wearable system enable the development of an obstacle detection system for visually impaired people, for example. The user is alerted of closed obstacles in range while traveling in their environment. The mobility system can detects obstacle that surrounds the deaf people by using multi sonar system and sending appropriate vibro-tactile acknowledgement, which, serves as an aid by permitting a person to feel the vibrations of sounds. It is known as mechanical instrument that helps individuals who are deaf to detect and interpret sounds through their sense of touch.

The Nottingham Obstacle Detector (NOD) is a hand held device subsumed with ultrasound. The device provides feedback as a unique note on the musical scale which is audible, and depicts the distance of the obstacle^[9].

The main reason for designing the Obstacle Detector Systems is to make the visually impaired person acknowledged about the obstacle beforehand. Such aid gives user more knowledge about the person's social environment and enables them to make decisions much more fastly, thus allowing them to move around more confidently and effectively. The cane may be used in the nearby milieu may be in a park, at work, at home, and while a long peregrination. The designed assisted device helps a visionless person to visualize the surrounding using the sensor and vibrations.

All the above sensor devices are internet of thing that will help for visually disabled people for their daily activity. By the help of these kinds of devices they can done their activities done as much as easy than early .and they can live as normal people.

3.3 Deaf - Differently able people

The communication between a deaf and a listener poses to be a serious problem compared to communication between blind and normal people. There are many IoT devices are available and researches are on going for a perfect solution for deaf and dumb. The new technologies are vibrate ring and hand talk.

3.3.1 Vibe ring

The Vibe ring system comes in the form of a wrist watch and a pair of rings which have to be worn on both hands. The rings are designed to act as the person's ears as they listen for sounds coming from behind the

individual. The wristwatch identifies the sound captured by the rings and presents the information to the person wearing it in an easy to read display manner^[10].

The rings are to be worn on both hands and are act as the ears that not only listen for sounds spread out from behind, they also find distance, position and vibrate according to source. The wristwatch aspect, identifies the sound wave and display this info to the wearer in an easy to read . The watch is programmed to listen for certain key phrases from humans like 'Hello.., your name being called and number of car noises including the most important one, a car's horn. It certainly helps the deaf to move around more fastly and normally.

3.3.2 Hand Talk

A setup data glove is equipped with five flex sensors, each of the flex sensors is meant to be fixed on each of the finger of the hand glove for the monitoring and sensing of static movements of the fingers of the hand. Whatever the person wants to communicate is activated by two ways either by hand gesture or by keypad in the device. This input is text is processed using a microcontroller. Further, the frequently spoken words can be stored in memory of APR9600 voice chip and can be easily retrieved by using hotkeys. The output from the LCD can be read by the dumb people and Speaker can be heard by the deaf people. This device helps in communication if attached to both the person involved in the communication who may be deaf, dumb, and Normal person^[11].

The flex sensor senses the sign language performed by the deaf people and produces the output. The output of the flex sensor is go to the Microcontroller through ADC. In the Micro controller chip we already programmed the particular word for each output of the sensor. This word is stored in the voice recorded chip and heard from the speaker. If the Controller accepts the input from the Keypad then, the output will be displayed in the LCD

3.4 Physical disabled –Differently able people

Physically disabled peoples mainly face problems in mobility with their limitations .so they are mainly depend wheel chairs for movement. Now days they are travel across society with some ones help. So researchers are developing internet embedded wheel chairs for physically disabled people. wheel chairs that connect to internet is an IoT, that made capable of challenged peoples to do their activities and travelling individually.

Wheelchairs that developed should include sensors, that provide shortest path if they want to go anywhere, if any unwanted situations occurs like any accident or such an emergency situations the wheelchair automatically should inform the doctor.

Bions are kind of sensor that help physically disabled people ,are Wireless, injectable micro devices that are versatile, robust and relatively inexpensive to implant in a variety of sites and applications. They also stimulate the functioning muscles of the body by providing electric signal; which will of course improve the performance of the body of physically challenged people .Many researches are going on in this area.

IV. Conclusion

Internet of things is a new state of art technology which if used carefully ,can help in improving the life style of everyone. One step ahead if we slightly decide the concept ,it can be the greatest help to the differently abled people .In this article ,I have tried to gather information regarding the different disabilities of the people, which made their lives monotonous one. If we can use IoT to assist in the way they want ,they may catch up their dreams a little closer. It can help the physically disabled people to move around , visually disabled people to reach their destination with the help of warnings and guidelines ,the deaf and dumb people to communicate in better way so that the speeler and listener may be comfortable with each other .I could list out only a few but definitely it will help the researchers in this area. The future world will surely bring light into the lives of differently abled people.

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