A Study On The Application Areas Of Iot To Improve The Life Of Differently Abled With Special Reference To Physically, Hearing And Visually Impaired Individuals.

[1]Dr.Rajdeep K Manwani , [2]Ms. Nasreen Sayyed
[1]Professor, Commerce Department, Jain University
[2]Assistant Professor, Commerce Department, Jain University

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 to some extent as normal people do. Disability is the consequence of an impairment that may be Physical, Cognitive, Mental, Sensory, Emotional and Developmental or some combination of the above. It may be right from the birth or may develop during a person's life time. This article analyses the living environment of Sensory and Physically disabled people, then presents how IoT can help them to overcome these difficulties.

Keywords: IoT, Disability, Sensory disability, Physical disability,RFID

1. 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 list of 3 items:

- By inherited (genetically transmitted);
- By congenital, because of mother's infection or other disease during pregnancy time , embryonic or fetal developmental irregularity condition, orby 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 and psychologically disabled. This paper mainly focuses on physical and Sensory (visual & hearing) disabled people.

1.1 Physical Disability

Physical disability is paralysis (completeor partial), severe weakness, interference with control, missing limbs, and speech impairment. Its causes include cerebral palsy, spinal cord injury, traumatichead injury (includes stroke), injuries or diseases resulting in amputation, ALS (Lou Gehrig's disease) or various diseases such as arthritisetc.

Limitations Caused by Physical Disability 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 who are 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 ofa mouse or pointing devices and have no option for keyboard control of the program. Individuals who can use only one hand or who use aheadstick or mouth stick to operate the keyboard have difficulty pressing two keys at the same time.

1.2 Visual disability

Functional Limitations Caused byVisual 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 colour distinction ability, poor night vision or a general hazing of all vision. Main difficulties using computers and software are that they have the greatest problem with information displayed on the screen. Mandatory use of a mouse orother pointing device requiring eye-hand co-ordination is also a problem.

Special programs exist to provide individuals with the capability to enlargethe screen image. There are also programs which allow the individual to have the contents of the screen read out loud. However, application programs sometimesdo 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 messageswhich 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. Accessto Documentation problems are written operating instructions and other documentation may also be inaccessible, if they are not provided an electronic oralternate form, e.g., audio 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 (forprinted text), and glare reducers. Many are helped extremely by use of larger lettering, sans-serif typefaces, and high contrast colouring. Top strategiesfor those who are blind or have severe visual impairments include the use of Braille, large raised characters or raised line drawings, Braille and audio.Note, however, that Braille is preferred by only about 10% of people who are blind and include 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 providingsimple labels on raised line drawings than for extensive text.

1.3 Hearing Disability

Hearing impairments are among the most pervasive chronic disability.Functional Limitations Caused to Hearing disabled fall into four categories.

• Individualsmay 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 whohave 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 shouldbe noted, however, that this is totally different language from English. Thus, deaf people who primarily use American Sign Language may understand Englishonly as a second language and may therefore not be as skilled with

English as native speakers. Individuals who are deaf may sometimes not speak; willhave difficulty in using telephone support services.

Special telecommunication devices for the deaf (TDDs) have been developed, which helps individualsto 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 supportservices, software companies would need to have TDD-equipped personnel. There are many kinds of assistive devices whichare available in the market which are helpfulto them for daily living. Assistive devices are devices which help disabled people for Mobility, Hearing, and 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. Devices provide help to disabled people;but they have many limitations. Technology is changing every day. One such emerging technology is Internet of Things which is consideredas the future technology of the world.

2. Introduction

2.1 Internet of Things (IoT)

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

British entrepreneur Kevin Ashton first coined the term in 1999 while working at the Auto-ID Labs (originally called Auto-ID centres - referring to a globalnetwork of RFID connected objects). IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machinecommunications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices is expected to usherin automation in nearly all fields, while also enabling advanced applications like Smart Grids, and expanding to 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 coastalwaters, automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue operations etc. [3]. These devices collectuseful data with the help of various technologies and then automatically flow the information between other devices. For example we wearjeans for 3 to 4 days without any hesitation, think of a day when our jeans informs us“it’s stinking, time for washing” through our mobile. That is Internet of Things. Here the jeans are connected to our mobile over the internet. A sensor attachedto the jeans senses the time for washing and informs the user. Sometimes it may take decisions like informing any nearbylaundryif we are busy. There are many applications of IoT like, Manufacturing, Energy Management, Infrastructure management, Medical and Health care, Buildingand automation, Transportation, Large scale deployment…etc. While the innovations are becoming recognized, there is potential to make a difference in fieldsother than business and security, and focus on how the Internet of Things can make a significant impact in health care, especially in the field of helping disabledpeople. With the IoT, it is expected that those with physical limitations will be able to interact, communicate, and possess physical controls througha 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 somewith disabilities difficult. Simple and intuitive

UIs would be keys to success in this regard. The things which can be connected to the internet to help the disabled people in any manner come under this category. A very simple example was in the Special Olympics itself. In 2009, the SpecialOlympics instituted RFID (Radio Frequency Identification) badges to the athletes that included name, biographical information, and medical history. TheseRFID badges can also be used to track the locations of athletes as they compete but most importantly, to provide medical staff with information shouldanything befall the athlete [4].

3. Related Work

With the IoT, the technology of the world will change and improve the living style of disabled people.They can lead their lives and overcome the limitations. IoT will help them in every instant of their life. After going through different works whichplay an important role in the life of differently able people. Let us introduce the RFID first and then take each case of differently ablepeople and then suggest methods of IoT to improve their life style.

3.1 RFID

The Internet of Things requires a few necessary components to enablecommunication between devices and objects. Objects need to be augmented with an Auto-ID technology, typically an RFID tag, so that the object is uniquelyidentifiable. Also, an RFID tag allows the object to wirelessly communicate certain types of information, which leads us to another requirement – the abilityto 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 intoa human-readable format.

RFID (Radio Frequency Identification) devices are wireless microchips used for tagging objects for automated identification. RFID can communicate wirelesslyto objects which embed and need not be in the line of sight. RFID tag and a sensor to read and measure data. The sensor may capture fluctuations in the surroundingtemperature, changes in quantity, or other types of information. Objects which also consist a RFID reader which is powerful and contains 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 can help disabledpeople in various areas. In case of visually disabled people, if they want to reach a particular destination or want to purchase from a mall the RFIDtags and readers will help them reach the exact location.

3.2 Solutions of IOT to Visually disabled –Differently abled people

Many internet embedded assistive devices are availablenow and continue to develop. Some technologies are mentioned here for visually, hearing and physically impaired. There are different numbers of possible solutionsavailable 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, which means thatit will know how to manipulate it. The cane can also include sensors for detecting distances and obstacles. There are optical, mechanical, electric,magnetic, and acoustic transducers.

An equip walky with ultrasonic sensors is taken as an example for this study. The reason the authors opted for an ultrasonic system was thatit was readily available, commerciallyproduced, and had a cost, which complied with the requirement specification for walky. With the aid of its ultrasonic sensors, walkyis 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-flightmethod.

The Mowat Sensor is employed with a pulsed ultrasound which is ordained with an analogue vibratory feedback operating overtwo ranges of distance: up to one meter a dump to four meters. The vibration frequency is inversely proportional to the distance between the sensor andthe object [7]. The Binaural Sonic Aid (Sonic guide) is a device which furnishes much information about aspects of the person's social environment whichlies 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 wirelesstechnologies, and in particular the ones used to locate persons or objects, can be used to realize navigation systems in an intelligent environment. Awearable system enables the development of an obstacle detection system for visually impaired people, for example. The user is alerted of closed obstaclesin range while traveling in their environment.

The mobility system can detect obstacles that surround deaf people by using multi sonar system andsending appropriate vibro-tactile acknowledgement, which serves as an aid by permitting a person to feel the vibrations of sounds. It is known as a mechanical tactileinstrument that helps individuals who are deaf to detect and interpret sounds through their sense of touch.

The Nottingham Obstacle Detector (NOD) is ahand held device subsumed with ultrasound. The device provides feedback as a unique note on the musical scale which is audible, and depicts the distanceof the obstacle [9]. The main reason in designing such Obstacle Detector Systems is to make the visually impaired aware of the obstaclebeforehand.

Such an aid gives the user more knowledge about the person's social environment and enables them to make decisions much more quickly, thus allowingthem to move around more confidently and effectively. The cane may be used in the nearby market, in a park, at work, at home, and while doing a long walk. The designed assisted device helps a visionless person to visualize the surrounding using the sensor and vibrations. All the above sensor devices are internetof thing devices that will help visually disabled people in their daily activities.By the help of these devices they can do their activities moreeasily thanbefore, and they can live as normal people.

3.3 Deaf - Differently able people

The communication between a deaf and a listener posesto be a serious problem compared to communication between blind and normal people. There are many IoT devices which are available and researchis on-going for a perfect solution for deaf and dumb. The new technologies are vibe 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'sears 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 act as ears that not only listen for sounds spread out from behind, they also find distance,positions and vibrate according to source. The wristwatch aspect identifies the sound wave and displays this info to the wearer in an easy to read manner. Thewatch is programmed to listen for certain key phrases from humans like 'Hello.., your name being called and number of car noises including the most importantone, a car's horn. It certainly helps the deaf to move around more quickly 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 fingersof 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 isprocessed using a microcontroller. Further, the frequently spoken words can be stored in memory of APR9600 voice chip and can be easily retrieved by usinghotkeys. The output from the LCD can be read by the dumb people and the Speaker can be heard by the deaf people. This device helps in communication if attachedto 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 thedeaf people and produces the output. The output of the flex sensor is sent to the Microcontroller through ADC. In the Micro controller chip we already programmedthe 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 acceptsthe input from the Keypad then, the output will be displayed in the LCD

3.4 Physical disabled –Differently able people

Physically disabled people mainlyface problems in mobility with their limitations .so they mainly depend on wheel chairs for movement.Researchers are developing internet embedded wheel chairs for physically disabled people. Wheel chairs that connect to internet is an IoT, whichare capable of making physically challenged people do their activities independently and travelling without assistance. Wheelchairs that are being developed include sensors, that provideshortest path identifiers when they want to go anywhere, and also unwanted situations like accidents and emergency situations are taken care of as the wheelchair automaticallyinforms the doctor or any other relative connected through the device. Bions are a kind of sensor that help physically disabled people, theyare Wireless, injectable micro devices that are versatile, robustand relatively inexpensive to implant in a variety of sites and applications. They also stimulate the functioning muscles of the body by providing electricsignal; which will of course improve the performance of the body of physically challenged people.

4. Conclusion

Internet of things is a new state of art technology which if used carefully, can help in improving the life style of everyone. If we think one step ahead and decide the concept, it can be the greatest help to the differently abled people. In this article, theauthors have tried to gather information regarding the differentTypes of disabilities of people, which make their lives monotonous. If we can use IoT to assist in the way theylive, they may be able to catch up with their dreams. It can help the physicallydisabled 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 speaker and listener may be comfortable with each other. The future world will surely bring light into the lives of differently abled people.

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