

DISABILITY AND DIGITAL DIVIDE: BRIDGING THE GAP THROUGH ARCHIMATE APPROACH

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ABSTRACT: Person with disability and older people need assistance in activities of daily living (ADL). Numerous models exist to view disability with a distinct perspective and provide/propose solution to address the effects and consequences caused by disability and limitation as a result of old age. Present study proposed and evaluated technological model of disability built on a famous enterprise architecture framework ArchiMate. Seamless integration of computing technology into environmental objects made it possible to construct a context-aware, pervasive computing environment that transforms itself according to the need of users by dynamically detecting the current user based on location-aware services. The proposed technological model of disability aligned the technological advancement with the disability rights law.

Key word: Technological Model of disability; ArchiMate framework; pervasive computing; disability assistance.

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INTRODUCTION

Persons with disability need assistance in living quality life. Physical and psychological effects caused by disability can be reduced by providing appropriate support and assistance (WHO, 2011). Model can minimize the gap between requirements associated with disabled community and available resources and assistance services. Different models have been developed to understand the requirements of disabled community so that based on understanding; maximum need of disabled community can be accommodated (Wasserman *et al.*, 2011). There exist several models associated with the study of disability with their point of view to understand disability, its associated need, effects and impact on disabled community and society (Llewellyn and Hogan, 2000). Models, in disability study, are important because they help in understanding a particular type of theory related to disability. As the impact of disability is multi-faceted, different models view issues and problem related to disability and proposed solutions to those issues. The medical model and social model of disability have a contrasting view regarding disability and economic model view disability as lacking in participation in work (Kaufman and Baker, 2005) and its consequences on economy (<http://www.akmhcweb.org/>).

Modern trends in Digital Society and Digital Divide: The impact of digital revolution in developed as well as in under-developed world is multi-facet and has significantly transformed the economy and other societal institutions including social, commercial, educational, cultural and economic activities (Helbing, 2015).

Information and communication technology has become an integral part of the life of people of modern society. It has changed the lifestyle of people by making access to the information easier without limitation of time and space. It makes social life more connected than ever with family, friends and other colleagues and facilitates them in acquiring public and private services (Lee, 2002 and Deb 2014). Technological advancement in the current era has potential to facilitate the marginalized communities by enhancing the quality of life (<http://www.akmhcweb.org/>) and empower them with more control over their activities. Accessible design of service KIOSK makes it possible for person with disability to enjoy the service they offer (Raja, 2016). It should be remembered that disabilities are of different kinds and different aspects are needed to be considered while making technology accessible (Simpson, 2009). Despite all benefits associated with ICT technologies, there exist a digital divide for the people with disabilities (Iskandarani, 2008).

It is pointed out in several studies that reforms in laws and making policies in accordance to avoid violation and discrimination against persons with disability has no significance without successful enforcement. Successful implementation of law improves the availability of accessible services in society, and alleviates violation of the human rights against disabled person (Drew *et. al.*, 2011). To make the technological advancement aligned with the disability rights law for those countries where law is available and providing guidance for those countries where the disability rights law is not available / enforceable, this research proposed a technological model of disability.

Enterprise architecture: Enterprise architecture is an approach for alignment of IT infrastructure to business

functions. Architecture is a blueprint that shows holistic view of enterprise. It describes different components of enterprise, makes their suitable placement and establishes relationship between these components in a way that helps in achieving optimal and goal oriented utilization of IT resources that supports business functions (Armour *et. al.*, 1999 and Minoli, 2008).

ArchiMate framework: The focus of ArchiMate Enterprise Architecture framework is on a consistent alignment and coherence across all the domains of

enterprise. ArchiMate framework, as depicted in Figure-1, presents clear concepts within an enterprise and makes relationship in different architecture domains of an enterprise that will offer a simple way for describing the contents of these domains (Gils and Dijk, 2012 and Glissmann *et. al.*, 2012). It has a uniform structure for modeling which is easy to learn and simple to apply. It is well tried and tested framework by many organization and has supported by The Open Group (TOGAF, 2015).

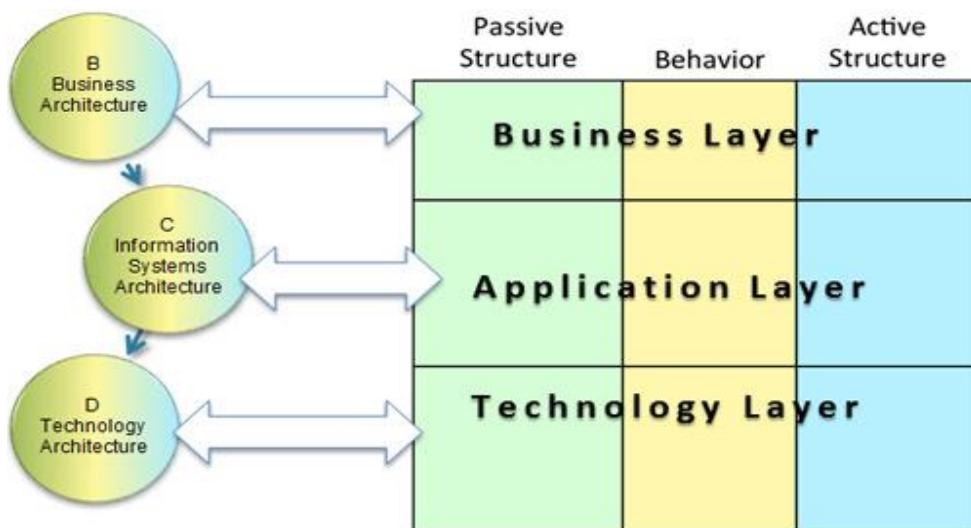


Figure 1: ArchiMate Framework

For technological model of disability, the research group selects ArchiMate framework because it offers a vendor independent standard and flexible layered architecture.

Disability and enterprise architecture framework: Human factor is an important factor in every Enterprise Architecture Framework, and disabled persons are sharing a remarkable percentage of world population (WHO, 2011). As demographic focal is observed a shifting from young toward older population (Farage *et al.*, 2012), the percentage of disabled population is also experience an increase in our modern societies (Díaz-Bossini and Moreno, 2014).

In study of different Enterprise Architecture Frameworks, it could be perceived that these Enterprise Architecture Frameworks do not consider the inclusion of disabled population in their implementation or perhaps the inclusion of disability factor is supported by these frameworks but is weaved into their design that do not explicitly mentioned.

Environment: Environment has great impact on a person's ability; specifically for the experience of disability. An inaccessible environment enhances the

extent of disability by creating barriers to participate in life and inclusion in society (Kaufman and Childers, 2009). Adaptation of accessible features can remove barriers present in environment. An accessible environment enhances disabled person's participation in daily life activities, improve their health conditions and prevent them from impairments. By modification in laws, changes in policies and by adapting technological development; accessible environment can be built.

There exists a need of understanding the disability in perspective of technology, for that purpose, this research proposed a technological model of disability based on ArchiMate Enterprise Architecture framework.

MATERIALS AND METHODS

Keeping in view the advantages of Enterprise Architecture framework, this study proposed a technological model of disability by using ArchiMate Enterprise architecture framework. The ArchiMate Framework is given in Figure-2.

A generalized design of proposed/modified ArchiMate Framework for disability factor is presented in Figure-3. Instead of introducing another layer or aspect

(view) in generalized design of original ArchiMate Framework. This study embossed the dimension of

disability support in ArchiMate framework.

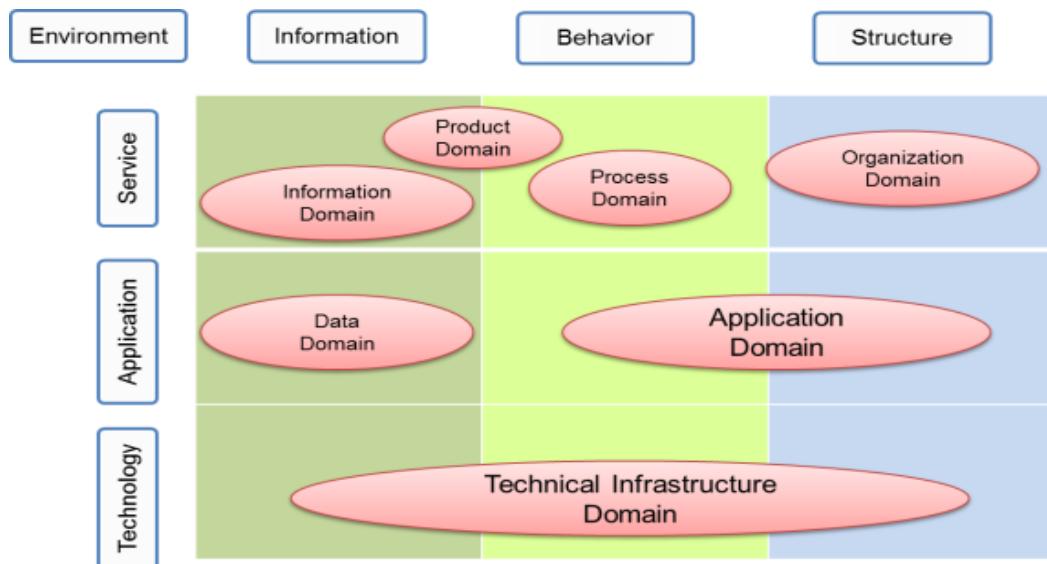


Figure 2 Generalized ArchiMate Framework

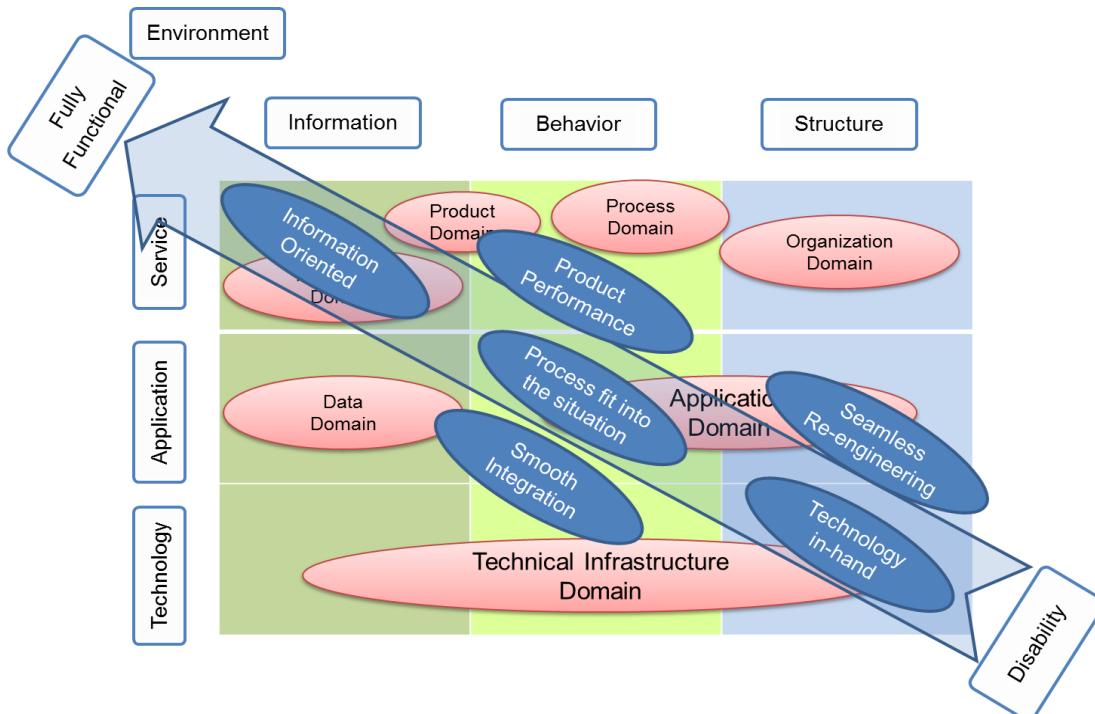


Figure 3 Technological model of disability based on ArchiMate Framework

The main objective of the dimension of disability was to construct a barrier free environment for disabled persons. The barrier free environment helps disabled persons to become fully functional by using advance technology in an information-oriented scenario. The disability layer consisted of six elements given below:

1. Technology in-hand
2. Seamless re-engineering
3. Process fit into the situation
4. Product performance
5. Smooth integration
6. Information oriented

Technology in-hand: As a generalized Technological model of disability, technology in-hand element represented the currently available advanced technological devices and equipment. Technological advancement has significantly improved different areas of life at modern society: communication, transportation, healthcare, education, leisure activities to name a few. Technology has the potential to change the life of disabled person and support them in activities of daily living.

As computing technologies became cheaper in price, smaller in size and faster in terms of computational power; it has now become possible to embed computer in different devices to create an intelligent environment. These smaller computing chips have different sensing capabilities and establish wireless connectivity. By embedding computing technologies into environmental objects, it became possible to construct a context-aware, pervasive computing environment. Using location-aware and detections services, the intelligent environment has capability to identify users and their associated need and based on the current user, environment transformed itself according to users' need.

There associated some social as well as economic consideration with the technological advancement and their integration into our daily life. Without appropriately addressing these considerations might result in loss of benefits from technology.

The technology in-hand element represented the currently available appropriate technology for supporting the disabled community.

Seamless re-engineering: Seamless re-engineering represented the design parameters of technology and applications intended to support disabled person. In application domain, the seamless re-engineering element represented the capability of technology and application due to which they could adapt changes seamlessly according to the change in the need of user and the environment. Interoperability is the main feature for the technological device and application to remain seamless for working with different standards or for which standards to be modified.

Process fit into the situation: The application layer of ArchiMate acted as a link between the business process and the technology. This element of technological model of disability represented the designing parameters of the process so that processes fit into every situation by using context-aware technologies and adapted changes dynamically. Small form factor sensors integrated into environmental objects with ability to transfer information could help process to modify them accordingly.

Product performance: The service layer of ArchiMate offered support to business functions of an enterprise. The product performance element in the service layer

showed the optimal achievement of products by smooth integration of flow of information. The function of this element in technological model was to keep aligned different state of the art technology. Aligning technologies with smooth flow of information helped in achieving optimal product performance.

Smooth integration: The element of smooth integration overlaps two layers: Technology layer and application layer; which showed the function of different technologies with supporting services for disabled person. Turning users' own environment into interface by smooth integration of technologically advanced features into environmental objects enhanced supporting service.

Information oriented: This element in technological model of disability was providing assistance to disabled and elder population in information oriented way. They are fully informed about the service and its usefulness, advantages and drawbacks. Disabled and elder person need to be fully informed about the technological assistance provisioned to them for their day-to-day care, healthcare, activities of daily living and workplace activities.

The devices would capable of information transfer to and retrieve from other devices in the environment and could communicate with servers and service provider without any intervention of human. However; the process of exchange of information should be carefully designed so that any information that violates users' privacy cannot be transferred without consent of user.

RESULTS AND DISCUSSION

The medical model of disability was a long discussed and accepted model. In this model of disability, the impairment was considered as the cause of limiting person's capability. The medical model tried either to cure the impairment by means of medically treatment or to care the disabled person. In contrast to medical model, the social model considered disability as a matter of environment or societal restriction. Due to inaccessible environment, a person is treated or considered as disable, because of barriers imposed by environment (Kaufman and Baker, 2005). The disability in economic model (<http://www.akmhcweb.org/>) has a totally different view. Disability is considered as a person's lacking in participation in work and its consequences on economy. Assistive technology helped disabled person in lowering the effects of disability and enabled them to actively participate in every walk of life. The technology acceptance model (Legris *et al.*, 2003) defined human aspects about technology and how factor of usability and perceive ease of use influenced human acceptance or rejection of technology.

Description of proposed model: The point-wise description of proposed technological model of disability is given below:

1. Development of a framework and code of practice which aimed to provide assistance that then led the direction of disability toward fully functionality in terms of service usability.
2. Provide services keeping the specific needs of disabled community and ensure that these services could be personalized accordingly.
3. Provision of information about services and assistance, so that disabled and elder person could make their own decision about service.
4. Design services for maximization of the participation of disabled/older person and to provide appropriate training with support about these services.
5. Using of the social media to raise knowledge in elder and disabled persons about these services.

Significance of proposed Technological Model of disability: The pace with which technology is evolving day by day and integrating into daily life is very fast. The process of law making, taken into enactment and enforcement took considerable time, thus became a process of slow pace (Drew *et al.*, 2011). Advanced features were continuously integrated into providing services through technologically advancement. However; consideration of Disability Rights law into these features for making them equally accessible for all was uncertain (Kaufman and Childers, 2009).

The proposed Technological model of disability helped disabled person to contribute in the society and in economy of country. It could benefit them as source of self-worth and generation of revenue by enabling them as an employee, as an entrepreneur or as a worker for social-welfare/volunteer organization. Technologies that enabled older and disabled person such as tele-worker – reduced the burden of travelling and enhanced workforce participation in the country. Providing information about assistive services and technologies, made disabled persons as decision maker about their life.

Technological complexity of proposed model: Keeping in view the importance of user's current environment, technologies that enabled location tracking and a connected environment can be used to facilitate the disabled and older people. The development of accessibility aids in which internet services are embedded could be found helpful in seamless re-engineering of services. Standardization for accessible devices, services and software was intended for enhancing product performance.

The availability small form-factor chips with capability of sensing; storing, processing data and wireless connectivity is now a common reality. These tiny chips consumed very less power and had much

processing capability. These features made this possible to embed and integrate computing technology into everyday object found in environment. The embedding and seamlessly integrating of computing technologies made computing ubiquitously and unobtrusively that provides support into daily life (Schmidt *et. al.*, 2005).

Person with disability and older people face barriers in using digital devices. This situation of facing barriers created a digital divide for them. At the same time, these digital devices and services can be exploited in a manner to become enabling tool for them. Controlling functionality through voice and eye gaze, interaction through brain-computer interface and other hardware/software features improved in access and enhanced usability. Integration of these technologically advanced features into everyday objects facilitated disabled and older people in enhancing quality of life. The use of software into device made them intelligent enough to configure themselves to accommodate users according to the need of users and changing into environment. Interaction with devices needed to be simple, intuitive and easy, so that disabled and older people enjoy an inclusive digital life.

In today's world, as a result of digital revolution, massive amount of information was generated and availed, however; much of information was context-dependent and was useful in very specific context. The challenge was delivering information to the user in the form that was pleasant and not annoying. Providing information exactly when and where it was needed by the user, was the approach of the proposed technological model of disability. The environment had an important perspective in assistance of disabled and older people.

Turning the user's own environment into the interface by embedding computing technology into objects, to support and provide assistance transparently and through such environment, the right information at right time and right place provided to disabled and older person while information was captured when and where it was created. Seamless integration of technology made it disappeared into environment and people had an unaware interaction with the computer.

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