

# A Systematic Literature Review of Accessibility and Usability Framework for Disabled Users

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**Abstract.** The term disability defined by Disability Discrimination Act 1995 is “A physical or mental impairment which has a substantial and long-term adverse effect on a person's ability to carry out normal day-to-day activities.” The disabled users cannot make use of information and communication technology and Internet because designers and developers do not follow the rules and guidelines for accessibility and usability. The Systematic Literature Review (SLR) methodology has been selected to discover the usability and accessibility framework for disabled users when they used information technology. After applying the inclusion and exclusion criteria, 13 publications have been reviewed and grouped together based on the similar quality attributes. This result shows that the usability and accessibility quality attributes are very important for disabled user's framework. From this review we could identify the suitable approach and the requirements to produce a better framework for disabled users based on the lessons learned from the previous works.

**Keywords:** Systematic literature review; accessibility; usability; disabled users;

## 1. Introduction

A disability can be defined as a state or function judged to be meaningfully impaired relative to the typical standard of an individual or group. The term is used to refer the people that have a physical or mental disability making involvement in certain of the normal activities of daily living more difficult. If an individual has had impairment in the past or is seen as disabled based on a personal or group standard or norm they may also qualify as disabilities.

The usability and accessibility are very important quality that can help the disabled users to use the information technology. “Usability” refers to a set of several concepts, such as execution time, performance, user satisfaction, security, effectiveness, efficiency and ease of learning (“learn ability”), taken together and accessibility can be interpreted as “the ability to access” the system or entity and often focus on people with disabilities and their access rights to an entity, by using assistive technology. Usability and accessibility have strong relationship with Human–Computer Interaction (HCI) because it has interaction with the users.

The objectives of this paper are:

- a) *To summarize the existing works towards improving accessibility technology for disabled users in context of framework.*
- b) *To identify the strengths and limitation of current usability and accessibility in order to suggest areas for further research.*

## 2. Review Process

### 2.1. Research Questions

There are five criteria that identify under the research questions which are population, intervention, comparison, outcomes and also the context. Table I shows the criteria and scope of research question structure.

Based on Table 1 the research question are:

- [RQ1] How many researchers propose framework accessibility and usability technology for disabled users and when is the earliest and the latest study?
- [RQ2] What are the important characteristics of framework for disabled users?
- [RQ3] How far the accessibility and usability achievements of the current framework for disabled users?
- [RQ4] What are the common flaws and strengths of the existing accessibility and usability technology for disabled user’s framework?
- [RQ5] What is the type of empirical evaluation for the usability and accessibility framework for disabled users?

Table I. Structure of Research Question

| <i>Criteria</i>     | <i>Scope</i>   |
|---------------------|--|
| <b>Population</b>   | Papers proposed accessibility technology framework for disabled users. |
| <b>Intervention</b> | Framework that address issues in accessibility.                        |
| <b>Comparison</b>   | Limitation and strength of each approach.                              |
| <b>Outcomes</b>     | Suggest improvement area of existing approach.                         |
| <b>Context</b>      | Accessibility technology framework for disabled users.                 |

## 2.2. Research Process

The search process was a manual search of specific journal paper and conference proceedings since 2000. The selected journals and conferences are shown in Table II. This strategy was deemed suitable after trial searches were performed when devising the SLR protocol. Eight electronic databases were searched during the SLR.

Five of eight were taken from Human–Computer Interaction source publication while seven were taken from Information and Software Technology (IST), Journal of Systems and Software (JSS), IEEE Transactions on Software Engineering (TSE), IEEE Software (IEEE SW), and also Empirical Software Engineering Journal (EMSE). Furthermore, references retrieved from articles acknowledged into the SLR were analyzed to discover any literature of interest that may have been ignored during the search.

Table II. Selected Journals and Conference Proceedings

| <b>Source</b>                             | <b>Acronym</b> |
|---|----------------|
| HCI Bibliography                          | -              |
| User Interface Engineer                   | UIE            |
| ACM Transactions on Accessible Computing  | TACCESS        |
| Information and Software Technology       | IST            |
| Journal of Systems and Software           | JSS            |
| IEEE Transactions on Software Engineering | TSE            |
| IEEE Software                             | IEEE SW        |
| Empirical Software Engineering Journal    | EMSE           |

### 1) Preliminary search strings in major indexing databases

The following search strings were formed in order to get the information from the electronic resources discussed. The search strings were formed after evaluating the keywords of related literature that was found during a general search of the resources defined above:

- “Disabled users” OR “handicapped users”
- “Framework for disabled users” OR “Framework handicapped users”.
- “Accessible framework for disabled users” OR “accessible framework handicapped users”.
- “Usability framework for disabled users” OR “usability framework handicapped users”.

2) Research in major indexing databases

Use the major indexing databases such as Google Scholar, IEEEExplore, ScienceDirect, Scopus, Digital Library, SpringerLink, and CiteseerX to refine the keywords. The refined keywords are “accessible AND framework AND disabled users.”

- 3) Record search results.
- 4) Categorize papers according to types of publications:

### 2.3. Qualitative Analysis

To fasten up the data extraction process, a form has been designed in order to be used to gather proof related to the research question and as a qualitative measurement for the study. Table III shows the questions being asked after analyzing the keywords chosen for this study.

Table III: Qualitative Analysis Questions

| QUALITY ASSESSMENT |   |                      |
|--------------------|---|----------------------|
| No                 | Question  | Answers              |
| Q1                 | Is the term/concept of accessibility framework clearly defined in the text? | Yes / No / Partially |
| Q2                 | Is the accessibility one of the keyword being listed                        | Yes / No / Partially |
| Q3                 | How many times the term accessibility is mentioned in the study?            | 5 or more/3-4/1-2    |
| Q4                 | Did the paper contribute to the research conduct?                           | Yes / No / Partially |

## 3. RESULTS

The results of this study are presented in this section.

The papers that have been selected follow the criteria as defined in Section 2. Figure 1 shows the number of publication years of the related studied. The earliest study is in 2004 continuing to 2007 that has one paper published. The number of paper increased in 2008, which has three publications. In 2009, the number decreased to two papers only, one in 2010, and there are significant increases in 2011, which published four papers.

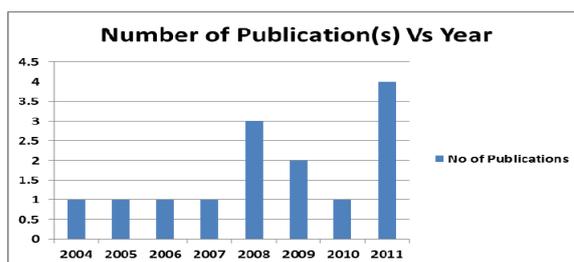


Fig. 1: Number of Publications vs Year

## 4. DISCUSSION

This section answers the research question proposed earlier on and several conclusions are obtained based on the findings.

### A. Finding about Research Question

*[RQ1] How many researches propose framework accessibility and usability technology for disabled users and when is the earliest and the latest study?*

This study includes 26 unique researchers that propose framework for disabled user. The earliest study is in the year 1997 [4] and the latest study is Support Development of Sign Language Human Computer Interaction [2]. The existing work proposes the concept of accessibility since 1997 [2] while for concept of usability since 2004 [9].

*[RQ2] What are the important characteristics of framework for disabled users?*

Several characteristics of framework for disabled users are identified from previous works since the year 1997 until 2011. From the SLR study, the important characteristics of framework for disabled users are accessibility and also usability. This two quality attributes are very important to disabled user when they access Web content. The usability leads to accessibility and vice versa. Without real usability, the real accessibility cannot be reached. These two qualities have strong relationship because if we try to implement accessibility without considerations for the larger context of usability normally results in less optimal solutions for the developers and for the users.

Most of the papers selected the accessibility and usability as their quality attributes in framework. These qualities are very important for disabled users for them to access any type information technology because for them, the only used of the technology is only to do the important work and not to play around with it. So we only provide the suitable and important quality attributes so that the disabled users will use the technology effectively. Besides that, the framework must meet the needs of activities of disabled users and also their limitation.

*[RQ3] How far the accessibility and usability achievements of the current framework for disabled users?*

From the study, we can see that the quality attributes for accessibility and usability are currently used in the framework that proposed in [2], [3], [5], and [7] to help the disabled user to access the information technology.

*[RQ4] What are the advantages and disadvantages of the existing accessibility and usability technology for disabled user's framework?*

The disadvantages of the existing accessibility and usability technology for the disabled user's framework is that the current framework causes some technical difficulties because of different type of disabilities will have different needs and different component of framework. This is happened because the framework is specifically designed to meet the accessibility and usability requirements of a particular user group and not cover for all type of disabilities. In addition, generic framework does not directly focus on the context of use, but it is necessary to meet the website usability requirements. The advantages of existing accessibility and usability technology for disabled user's framework follow the standard guidelines such as Web Content Accessibility Guidelines WCAG 2.0 and it makes the framework useful. Other than that, the framework propose in [1] and [6] can re-use the accessible digital training resources and retaining their interoperability between various platforms.

The accessible technology for disables user is still far from being accessible by students with specific learning disabilities. This is because the different type of disabled users will handle the different types of needs. It is very difficult to design the framework or website that enables all the type of disabled users can use it. The main idea of accessible technology framework is to develop the suitable framework that can be access by all the disabled users.

There is a set of requirements to identify the problem that faces by the disabled users but the problem comes when we try to develop the framework that can be accessible by all type of disabled user.

*[RQ5] What is the empirical evaluation for the usability and accessibility framework for disabled users?*

Paper [2] and [6] use the proposed the experiment for the empirical evaluation to validate the framework. In paper [2] it has two instances; design of the framework architecture itself and the limitation and the careful task of addressing the various issues detected in several studies while authors [5] used the experiment for the empirical evaluation to validate their framework which has two users with different disability and also build the prototype of a smart house. Other than that, paper [1] and [6] use the case study for the empirical evaluation to validate the transformation of the existing framework. The empirical evaluation such as experiment and case study are used to validate the usability and accessibility framework for disabled users. This type of evaluation will make the user satisfy with the framework.

## 5. Conclusion

A Systematic Literature Review (SLR) on framework for disabled users presents the latest challenges and approaches by identifying the related publications. There is a possible work to further study, and evaluate, the success highlighted in this SLR of using accessible technology framework to support and helps the disabled users. From this study, the number of publication that focuses on accessibility and usability framework for disabled user increased in 2011. There are several important criteria that we should consider such as requirement, quality attribute and also the empirical evaluation to improve the current framework for disabled users that have been discussed in this paper. Our future research is to formulate a framework for disabled users that is able to fulfill the above requirements.

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