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Prototype and User Interface Model of Decision Support System for Children with Disabilities in Pandemic

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Abstract

The COVID-19 pandemic has posed significant challenges to healthcare services, particularly for children with disabilities who require specialized support, technology provision, and necessary supplies. The COVID-19 pandemic has shaken the world over the past year, with many face-to-face services and services suspended for adults and children, including children with disabilities. This study presents the design and development of a Decision Support System (DSS) prototype with a user interface (UI) model tailored to meet the needs of healthcare services dealing with children with disabilities. The system or DSS prototype with User Interface/User Experience (UI/UX) aims to be user-friendly. It prioritizes accessibility, ease of navigation, and adaptability, offering a user-centric solution from essential component UI. Designed following best practices in UI/UX for accessibility, the system includes customizable options to accommodate varying user needs and cognitive load. This work contributes to a framework for designing accessible DSS in a crisis, supporting more resilient and responsive care for vulnerable populations.

Keywords: Prototype, User Interface Model, Decision Support System, Children with Disabilities, Pandemic

1. Introduction

The COVID-19 pandemic has shaken the world over the past year, with many face-to-face services and services suspended due to the rapidly spreading outbreak and almost all communities worldwide. COVID-19 [1][9] has exposed critical challenges in healthcare delivery, especially for vulnerable populations such as children with disabilities. These children often require consistent, specialized support that relies heavily on face-to-face interactions, digital technology support, healthcare providers, and educators. With pandemic restrictions limiting access to many things, including traditional care, there is an increased need for digital solutions to provide timely and remote support for families and children with disabilities [1][9]. Decision Support Systems (DSS) [2-4], which leverage data-driven insights to aid decision-making, offer a promising solution to bridge this gap by providing critical guidance and support in remote settings [5]. Current applications of DSS in healthcare have demonstrated effectiveness in providing recommendations, on-demand provision, health monitoring, displaying required features, and data analysis. However, many DSS tools are not explicitly designed with accessibility features to meet the unique needs of children with disabilities [3], who may face additional challenges with digital literacy or accessibility [2]. Effective DSS [27] design for this demographic requires careful consideration of user interface (UI) and user experience (UX) elements that address a range of physical, cognitive, and sensory needs [7]. Designing an accessible UI not only ensures broader usability but also enhances the impact of the system by empowering caregivers to make informed decisions and access resources more efficiently (World Health Organization, 2021) [6].

The unique needs of children with disabilities and their caregivers require a tailored approach to DSS development. For example, high-contrast visuals, large buttons, simplified navigation, and clear color-coded alerts can significantly reduce cognitive load and support faster decision-making for caregivers under stressful

conditions [4]. These design elements are particularly relevant during unforeseen circumstances such as the COVID-19 pandemic, where caregivers may face increased anxiety and resource constraints [3].

Given these challenges, this study aimed to develop a prototype DSS with an accessible UI model designed for caregivers of children with disabilities [7-8]. The system prioritizes usability, accessibility, and adaptability and addresses the urgent need for digital solutions supporting remote care during a health crisis. Specifically, this study included (1) a detailed design process focused on user-centered design principles for an accessible interface, (2) the development of a functional prototype tailored to the needs of children with special needs, and (3) the implementation of a UI [9] that is consistent with the ease of use of the system for non-technical users.

By contributing an accessible and user-friendly DSS tailored for children with disabilities, this study offers a health alternative for a vulnerable population during a pandemic or outbreak [8][10]. It addresses the need for adaptable, intuitive DSS tools that can be readily implemented in pandemic or emergency scenarios to support continuity of care for children with disabilities. During the pandemic, the urgency of DSS Healthcare has underscored the importance of user-centered, accessible DSS tools that empower caregivers and reduce reliance on traditional, in-person services [5]. The resulting prototype provides a framework for designing targeted, tailored design solutions that ultimately promote equitable access to services for children with disabilities [7].

2. Literature Review

The COVID-19 pandemic has highlighted the importance of digital health solutions to support remote care for children with disabilities. Although Decision Support Systems (DSS) have been widely implemented across healthcare settings, most existing models lack the specific design considerations needed for children with disabilities and their caregivers [1]. A literature review of DSS, which explains user interface (UI) design and accessibility in healthcare, provides insight into current challenges and areas for innovation in developing DSS prototypes tailored to the unique needs of this population.

A. Decision Support Systems in Healthcare

DSS has become an essential part of information technology development. DSSs are not just digital tools that help deliver systems, including health care, and can provide data-driven decisions; they also offer access to health metrics, diagnostic support, and comprehensive recommendations. DSS applications have significantly improved remote patient monitoring and decision-making efficiency, especially during health crises [2]. In pediatric healthcare, DSS has shown promise in supporting by providing real-time insights and alerts on key health indicators [3]. However, DSSs are not explicitly designed to accommodate the accessibility needs of children with disabilities, limiting their usefulness for this demographic group. Research highlights that parents and caregivers of children with disabilities often experience information overload, cognitive strain, and increased stress levels, emphasizing the need for DSS that simplify the decision-making process and prioritize usability [4].

B. Accessibility and Usability in DSS Design

Accessibility is an essential factor in the design of healthcare applications, especially for users with disabilities and non-specialist caregivers who may have limited digital literacy. The World Health Organization (WHO) has emphasized the importance of adhering to the Web Content Accessibility Guidelines (WCAG) to ensure that healthcare systems are accessible to a wide range of users [5]. Effective DSS design for accessibility incorporates features such as high-contrast interfaces, simplified navigation, and adjustable font sizes, which collectively reduce cognitive load on users and increase user satisfaction [6]. In addition, including visual aids, color-coded alerts, and auditory feedback can improve accessibility for users with sensory impairments [7]. This benefits users because it supports a more user-friendly design and user experience, making it easier for all groups, especially children with disabilities.

Studies have shown that accessible UI design can significantly improve usability and engagement among non-technical users, which is vital in stressful contexts such as caregiving during a pandemic. For example, Adams et al. [6]. showed that high-contrast visuals and large icons improved usability for older adults, teachers, caregivers, or users with limited technology experience [8]. Given these findings, an accessible UI model in DSS can

empower caregivers by providing an intuitive and easy-to-understand interface that supports efficient decision-making without adding complexity to their tasks [9].

C. User-Centered Design for Children with Disabilities

User-centered design (UCD) [18-19] is a design approach that focuses on understanding and meeting the needs of end users, in this case, children with disabilities, caregivers, and health care providers for children with disabilities. UCD has been recognized as necessary in healthcare applications, as it emphasizes ease of use and relevance to real-world situations [10]. In designing a DSS for children with disabilities, UCD principles were applied to identify and address specific needs, such as easy access to health metrics, apparent communication features, and reliable telehealth options. Research highlights the role of task simplification and personalization in UCD, which can facilitate higher caregiver engagement and reduce errors associated with complex interfaces [11].

Through surveys and interviews, previous researchers [12] have identified standard caregiver requirements, such as immediate access to health information, a reliable alert system, and customizable settings that meet each child's unique needs [12]. These features are integral to the design of DSS for children with disabilities [20-22], as they enhance the user experience and support caregivers in managing their responsibilities effectively, particularly in a remote environment. Nguyen et al. [13-15] emphasized that involving caregivers in the design process ensures that DSS [23][26] addresses their specific challenges, increasing satisfaction and usability [13].

D. Challenges in Remote Support for Children with Disabilities during the Pandemic

The pandemic has increased the demand for digital healthcare solutions, but many existing systems are not prepared to meet the specific requirements of children with disabilities. Face-to-face services are limited, leaving caregivers or users to manage complex care routines [29-31] without adequate support. Digital tools for remote health monitoring and support have provided some relief but often fail to accommodate the diverse needs of children with disabilities, leading to accessibility barriers and caregiver frustration [14]. Research during the pandemic revealed that users experienced difficulties accessing reliable information and obtaining accurate, appropriate, and timely medical advice, underscoring the urgent need for DSS [17][20][27] that provide comprehensive and easy-to-use solutions, especially for children with disabilities [15].

DSS tools [16][21] are commonly used in healthcare, yet significant gaps exist in their accessibility and usability for children with disabilities. The literature emphasizes the importance of a user-centered approach [22-24], accessible design, and specific functionality to ensure these tools truly support caregivers in remote settings. This study aims to address these gaps by developing a DSS prototype [12–17] with a UI model that integrates accessibility, intuitive navigation, and caregiver-focused features. Such a prototype has the potential to not only improve care outcomes for children with disabilities but also reduce stress on caregivers during health crises.

3. User Interface Design and Prototyping

A. Requirement Analysis & Persona Development

We can see the user research and requirement gathering from the requirement analysis. Requirements were synthesized from user feedback, focusing on essential functionalities like features and resources for pandemic-related care. Based on this analysis, we defined the primary DSS [27] features to prioritize accessibility and ease of use. Another step concerns Persona Development for UI/UX [10-12][28]. User personas were created for primary user types [30]: children with disability, the Management division, caregivers, healthcare providers, and special educators. Each persona included specific needs, behaviors, and challenges in using digital tools.

B. Wireframing and Prototype Development

Low-fidelity wireframes were created to establish the layout, followed by high-fidelity prototypes using Figma [11-14]. These prototypes were then tested iteratively with user feedback, focusing on navigation simplicity, color contrast, and button size. With Figma, the model can be created depending on the need and action of user performance. Prototype Development Tools and Technology have components:

• Design Tools: Describe tools used for prototyping, such as Figma or Adobe XD, and how they support accessibility features.

• Technology Stack for Implementation: If developing a working prototype, list the backend and frontend technologies chosen for the DSS (e.g., React for UI, Firebase for real-time data storage).

• Prototype Features: Describe how key features are simulated in the prototype to allow realistic interaction during usability testing.

C. UI/UX Design for Accessibility

Accessible design principles, such as those outlined by the World Wide Web Consortium (W3C), emphasize the importance of inclusivity, especially for individuals with disabilities (W3C, 2020). The research underscores the significance of UI features like simplified navigation, large buttons, and color contrast to ensure usability for caregivers and children with varying needs [15]. UI/UX has design principles:

1. Accessibility: Discuss the applied principles, such as WCAG (Web Content Accessibility Guidelines), including high contrast, screen reader compatibility, and simplified language.

2. Intuitiveness: Outline strategies to ensure the DSS [17-18][23] is user-friendly, such as a clean layout, step-by-step navigation, and a straightforward color-coded interface to easily interpret alerts and recommendations.

3. Customization: Explain features that allow caregivers to tailor the interface based on their specific needs, such as setting personal reminders, creating child-specific profiles, or adjusting language and interface sizes.

D. Key UI Components and Features

• Home Dashboard: Describe a centralized dashboard where caregivers can view all essential information at a glance, such as the child's health metrics, alerts, and recommended activities [23-26] [34].

• Monitoring and Alerts: Detail the UI [33] for monitoring critical health metrics, setting alerts for abnormal values, and visual indicators [34] (e.g., color-coded metrics for immediate awareness).

• Guided Support and Resources: Include a section that provides personalized recommendations, educational materials, and pandemic-specific guidance.

• Communication Module: Explain the design of the communication feature, which enables caregivers to contact healthcare providers quickly through chat, video calls, or secure messaging.

• Settings and Customization: Outline the design of the settings panel, where users can manage their profiles, adjust accessibility settings, and configure notifications.

E. Gaps in Existing Research

Current research lacks a focus on DSS designed for remote caregiver support during crises, particularly with accessible and adaptable UIs for children with disabilities. Developing a DSS that meets these needs could improve care outcomes by empowering caregivers and reducing healthcare disparities [8][12].

4. Requirement Capturing on DSS

A. Analysis of Functional Requirements or System

Especially when creating a program targeted at children with disabilities during a pandemic, requirement collecting or requirements capture is a vital stage in software engineering and technology development procedures [24-27]. This stage comprises numerous persons or parties from the perspective of children with special needs [22] [28] and those directly involved, such as teachers, society, or communities. One must know exactly what is required by use of requirement capturing. During this research, UML (Unified Modeling Language) [12][19] and table requirements are applied to help make it easier to capture.

This part covers the software's functional and non-functional criteria. The list of needs is presented in tabulated form. The Unified Modeling Language (UML) is used, which uses case diagrams and requirement tables. Use

case diagram descriptions are applied in system design. Using a programming language example, the UI UX programming language creates a user interface. The need for the software's features and utilities to be developed constitutes its functional requirements. Functional requirements help you understand the program's capability. The description of the need description table (provided in Table 1 and Table 2) follows.

- First character: "F" or "N," either functional or non-functional
- Second character group: two letters for General Requirements, "GR" and "PR," for Platform needs.
- Data management needs "MN," transaction needs "TM." FGR01, FPR01. Every demand has a quantifiable description. Every need has a priority; 'MUST' is the implemented need based on this. The need for "OPTIONS" shall only be followed when time allows.
- The search column enables mapping the demands in the Use Case (requirement definition).

Software functional requirements (SFR) help define the direction of the system and the needs that will be used and developed. They also help academics understand the exact goals, responsibilities and challenges the program must overcome. For a project like a children's handicap program, this is vital, as the needs can be complex and instead tailored. Engaging stakeholders guarantees the project is user-centered, reducing the likelihood of producing software devoid of necessary functionality [12-14].

Table 1. General Requirements

Req ID	Description	Priority
FGR01	Requires a login process when the user interacts with the system.	MUST

Table 2. Platform Requirements

Req ID	Description	Priority
FPR01	The Platform or server uses the Windows 10 or Windows 11 operating system.	CHOICE
FPR02	The database uses SQL Server, MySQL, or Microsoft Access.	CHOICE
FPR03	Using the Python, VB.NET	CHOICE

Table 3. Functional Requirements

Req ID	Description	Priority	Use Case Id / Comment
FLA01	The program shows a login form meant to verify system users.	MUST	UCLA01
FMN01	The application shows a user login management form to handle data for interaction with the program.	MUST	UCMN01
FMN02	The application processes data using the Children's Disability Data Management Form (MO).	MUST	UCMN02
FMN 03	The tool processes appraiser data using a data management form.	MUST	UCMN03
FTM01	The program shows children data assessment transactions for processing data profiles of children with disabilities.	MUST	UCTM01
FTM02	The application uses profile matching and Promethee techniques to process Children's disability data assessment information, showing the MO assessment data management form.	MUST	UCTM02

B. Non-Functional Needs

Requirement capturing calls for non-functional since it relates to performance, usability, security, scalability, and others. Demand capture depends on them.

- Performance: Using assistive technologies [32] calls for a rapid and responsive application.
- Privacy and Security: Laws about security and privacy mandate private information such as medical

doctor conditions.

- Usability: Examining usability is vital. Children, parents, and other caregivers must find the program easy to use.
- Scalability: The system should be flexible enough to accommodate fresh types of disabilities or other therapy approaches.
- Availability: Particularly for rehabilitation programs that are often used, they must be dependable with low downtime.

The following summarizes the program's non-functional needs; they aim to create conditions relevant to supporting regular software activities in Table 4.

Table 4. Non-Functional Requirements

Req ID	Name	Description	Priority
N01	Performance	Either sooner or later, the application connects to the database and shows it to the user.	CHOICE
N02	Performance	The kind of computer utilized.	CHOICE

C. Generating Use Cases on DSS

Using cases seeks to explain how the system behaves against the expected functions. Finding the people involved comes first; defining the use cases for each actor comes second; and lastly, you model the event scenarios for every use case. Actors portray items or people the application will encounter. This application specifies one (maybe one or more) actor to interact with it. We can see this in Table 5.

Table 5. Actors in DSS Modelling

Actor Name	Definition
Admin	The admin is capable of managing login data (including adding, editing, and deleting), managing children's disability data (including adding, editing, and deleting), overseeing data management (including adding, editing, and deleting), handling children's disability assessment data management (including adding, editing, and deleting), and managing assessment data with methods (including adding, editing, deleting, and printing reports). The admin can also freely carry out all tasks within the system.
Decision Maker or Expert	The user can manage login data (including adding, editing, and deleting), assess children's disability data (including adding, editing, and deleting), and handle assessment data with methods (including adding, editing, deleting, and printing reports).
Children	The Decision Support System is accessible for users to view.

Figures 1 and 2 show the application of the Student Disability Decision Support System in the use cases. In Figure 1, we can see several users or actors and cases or activities that occur; there are four user components: Admin, Children with Disabilities, Parents, and Head of Health Department. The admin has access to several things, from login, data management, and child data to being able to exit the system. Children with disabilities or parents can only access Login and Children's Data.

- Diagram Admin or User for Management Case:

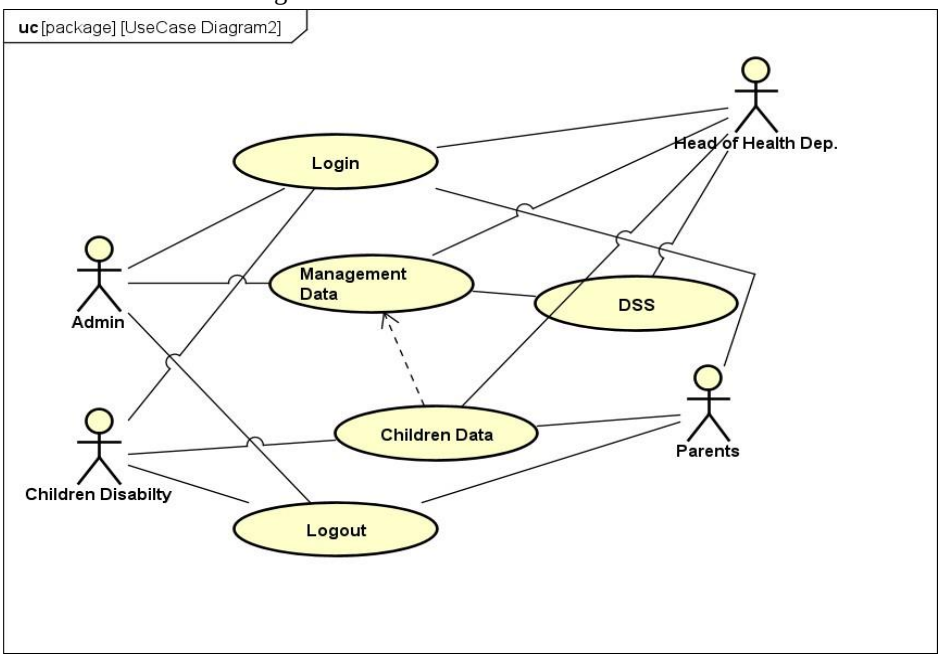

Figure 1. Use Case DSS and Actor

- Use Case Diagram Admin or User for Login

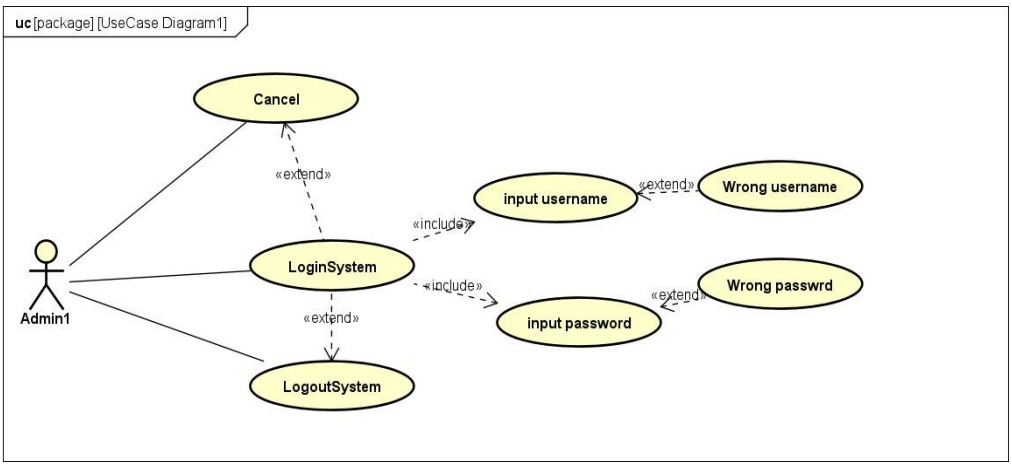

Figure 2. Use Case Diagram Admin / User Login

From Figure 2: For Use Case Login, admin or user who inputs username and password. The system will display the main page if the username and password are valid. If the username and password are not valid, the system will be a member display a message indicating that the username and password are invalid.

5. User Interface and Design Layout for DSS

This chapter on Analysis and Design will not cover all layout designs related to applying the Profile Matching Method as a Decision Support System for selecting high-achieving students with disabilities. The discussed layout designs represent input and data management, assessment and calculation processes, and output within this system.

A. Main Menu

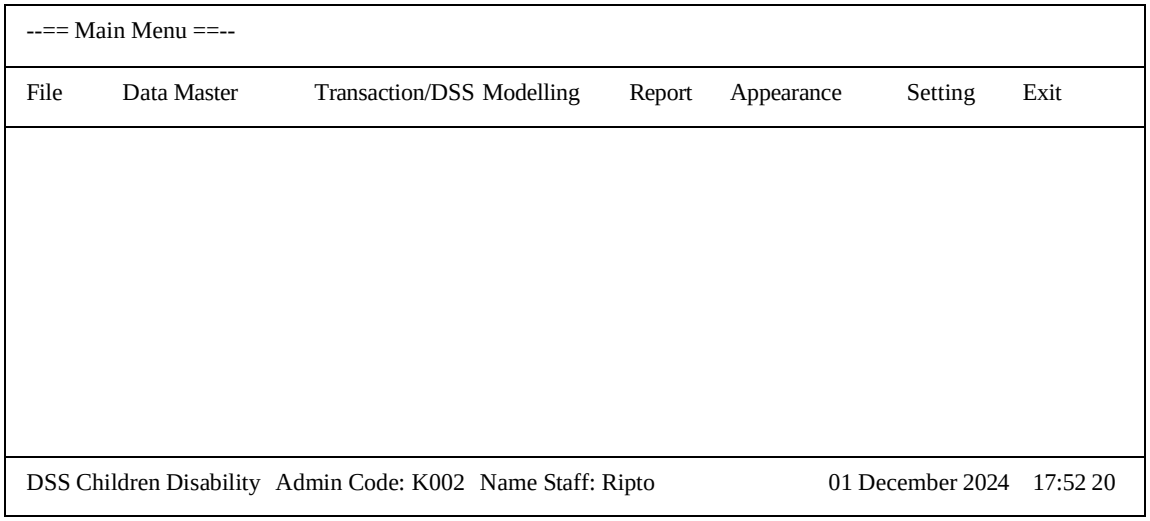

Figure 3. Layout Main Menu

Upon launching this software in Figure 3, a screen will present an empty form featuring the primary menus: File, Master Data, Assessment Transactions or DSS Modelling, Reports, Display, and Exit. Upon selecting the file, user data will be displayed. Upon determining the Master Data, the Student Disability Data and Data Checker menu will be displayed. The DSS Modeling Section includes Assessment of Student Disability, Assessment Criteria for Student Disability in the Red Zone, and further sub-menus. In the Report Section, we can print the data results.

B. Data Login DSS Student Disability

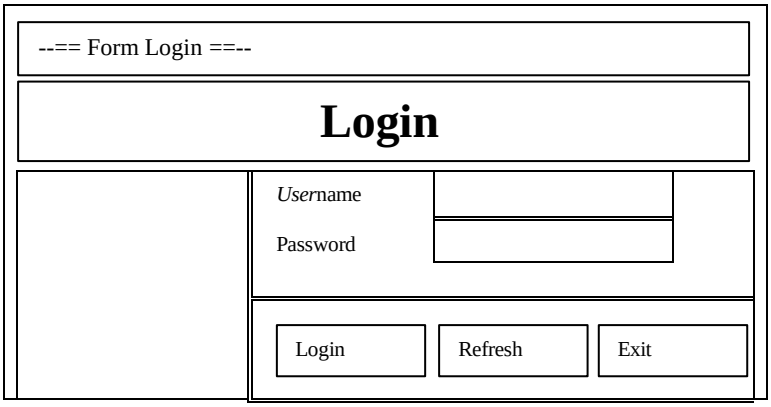

Figure 4. Figure Layout Login DSS Student Disability

Users use the DSS Child Impairment Selection Login Data Form to submit a username and password, enabling access to the application software. If the input is valid, the system will show the program's main menu depending on the access rights of every user status; if not, the system will finish and return to the beginning, as depicted in Figure 4. The system will check the input from the user during the login process to see if it is valid.

When there is an error, or you wish to delete information rapidly without removing it one by one, the Refresh button allows you to remove information in the username or password. The Exit button is meant to leave the DSS Student Disability system.

C. Figure Layout Data

For Layout Data, we can see Figure 5. This Figure shows that the user data form is mainly used to enter user data into the application. Clicking on the User Data menu after choosing the File option will show this form. You must have an account on this user data form by completing all the current text fields and ascertaining your account status before proceeding further into other forms, in this case, using your access privileges.

Once the above procedure is finished, data addition comes next. Pressing the add button will add the filled-in text field data to the extra data form. The refresh button will bring the form back to its original condition. Should data not be needed, a delete button allows one to remove it.

The menu options in the search area guide data searches in different directions. The user will choose the menu and press the search button after filling in the text field. The data will then show based on the search box's command entered. Just hit the escape button to leave.

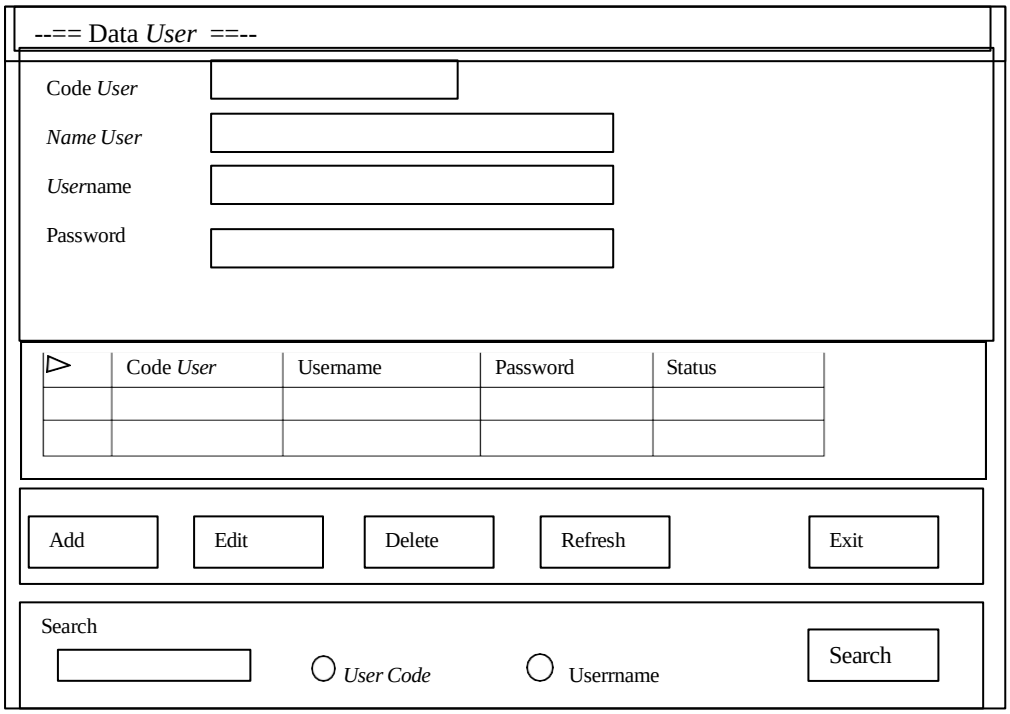

Figure 4. Figure Layout Login DSS Student Disability

D. Aspect of Key UI on DSS Disability

The previous chapter explained the aspect of the UI component. This section will explain ten UI aspects, starting with the Home Dashboard, Management Dat, and Resource and ending with the Exit Menu in Table 5.

Table 5. Aspect of Key UI

No	Name of Aspect Key of UI	Information	Location
1	Home Dashboard	Available	Main Menu
2	Management Data	Available	Form Data
3	Resources and Support	Available	Main Menu
4	Settings and Customization	Available	Main Menu
5	Error Handling	Available	in Every Form
6	Login User	Available	Login Menu
7	User Control	Available	Main Menu
8	Date and Time	Available	Menu

No	Name of Aspect Key of UI	Information	Location
9	Hands Book of Information	Not Available Inside, Available Outside	About on Main Menu
10	Exit Menu	Available	Main Menu

6. Conclusion

This paper presented a prototype and UI model for a DSS to support children with disabilities during the pandemic. Several layout design results, UML, and aspect tables show the importance of designing DSS tools that prioritize accessibility and adaptability, especially in crisis scenarios. The system or DSS prototype with User Interface/User Experience (UI/UX) aims to be user-friendly and accessible. It prioritizes accessibility, ease of navigation, and adaptability, offering a user-centric solution from key UI components. The system includes customizable options to accommodate varying user needs and cognitive load for vulnerable populations in the research study, namely children with disabilities. Further development will focus on expanding features, providing the next layout model, integrating telehealth, and conducting large-scale testing. Future research should explore machine learning to enhance personalization further.

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