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School of Engineering

A Project Report on

"Udyog Saarthi App - (Progressive Web-based Application) for Adults undergoing Job coaching for opportunities under 4% reservation in NIEPMD and other Institutions"

Capstone Project (CSE7101)

Submitted by

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Chapter 1: Introduction

1.1 Problem Statement

Unemployment among Persons with Disabilities (PwDs) in India continues to be a long-standing socio-economic and technological challenge. Although laws such as the Rights of Persons with Disabilities Act (2016) mandate a 4 percent reservation in government jobs for categories including Intellectual Disability, Autism Spectrum Disorder, Multiple Disabilities, Mental Illness, and Specific Learning Disabilities, the actual impact on employment remains limited in real practice.

One of the major causes behind this gap is the lack of a dedicated, accessible, and easy-to-use platform that effectively connects eligible PwD job seekers with appropriate employment opportunities. Most existing job portals are built for general users and do not support the specific accessibility needs of PwDs. These sites often have visually dense layouts, limited support for assistive tools like screen readers, and rely heavily on high-speed internet, which makes them difficult to use in low-bandwidth regions.

Another hurdle is the absence of clear and continuous communication between recruiters and

applicants. Many candidates do not receive proper feedback or reasons for rejection, leading to reduced motivation and lower participation. Employers also face difficulties in filtering applicants based on disability type, skill level, or reservation category due to the lack of a structured system. This results in a continued mismatch between job requirements and eligible candidates, ultimately increasing unemployment and underemployment within the PwD community.

The Udyog Saarthi Project is designed to address these issues by offering an inclusive, centralized, and technology-supported solution. By utilizing Progressive Web Application (PWA) technology, the project aims to provide an accessible, responsive, and installable digital platform that bridges the persistent information and opportunity gap faced by PwDs, thereby contributing to a more equitable employment ecosystem.

1.2 Motivation

The motivation behind creating the Udyog Saarthi App stems from the need to use technology as a tool for meaningful social impact. As reported by the Ministry of Statistics and Programme Implementation, almost 64 percent of India's PwD community is unemployed. This number represents far more than a statistical gap—it reflects the exclusion of a large population from the dignity, stability, and sense of purpose that employment provides.

After observing these challenges closely, the development team understood that the real strength of technology lies in its ability to include, not just innovate. With the evolution of modern web technologies, especially Progressive Web Apps, there is a strong scope to design solutions that remain accessible to people with varying physical, sensory, or cognitive needs. PWAs offer the combined benefits of mobile apps and web platforms, such as offline availability, low data usage, and installation across devices, making them ideal for users in low-income and remote regions.

The project also draws inspiration from national initiatives like Digital India and the Accessible India Campaign (Sugamya Bharat Abhiyan), both of which highlight the importance of equal access to digital tools and infrastructure. By developing an application that is simple, responsive, and compatible across different devices, Udyog Saarthi aspires to contribute to inclusive development. This motivation goes beyond technical interest—it is grounded in empathy, social awareness, and the vision of building a platform that uplifts a widely underserved community.

1.2 Project Objectives

The Udyog Saarthi Application is conceptualized as a Progressive Web-based platform that connects job seekers with disabilities to employers through a unified and accessible interface. The objectives of this project span across primary, functional, and social dimensions.

Primary Objective:

To create and deploy a fully operational, user-friendly, and accessible Progressive Web Application that acts as a dedicated job portal for Persons with Disabilities who fall under the 4 percent reservation categories.

Functional Objectives:

• To offer PwD users a simple, clear, and easy-to-follow registration and profile-creation process.

• To build an administrative module that allows authorized institutions or employers, including NIEPMD, to publish, update, and manage job postings.

• To implement a disability-oriented job-filtering feature so that users can quickly find opportunities suited to their abilities and skill areas.

• To incorporate a transparent feedback system where rejected applications clearly display the reason for removal, helping users refine future attempts.

• To support key PWA features such as offline accessibility, lightweight usage, and the ability to install the application on both mobile and desktop devices.

Social Objectives:

• To support the economic independence and overall empowerment of PwDs.

• To encourage inclusive hiring practices aligned with the United Nations Sustainable Development Goals—SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), and SDG 10 (Reduced Inequalities).

• To show how well-designed digital solutions can positively impact society by ensuring fair access to opportunities.

1.4 Scope and Limitations

Scope:

The scope of the Udyog Saarthi Project covers the complete design and front-end

development of a Progressive Web App created specifically for PwDs seeking employment under the 4 percent reservation system. The platform includes modules for user registration, login, job posting, application tracking, and feedback management. It makes use of browser-based localStorage for handling essential data such as user accounts, job listings, and application statuses. In addition, the app incorporates PWA functionalities—including a manifest file and service workers—to support offline usage and allow installation on mobile devices.

The design approach places strong emphasis on accessibility standards, featuring readable typography, intuitive navigation, compliant color contrast, and simplified page structures to support individuals with visual or cognitive limitations. Although the system is intended mainly for academic demonstration, its structure is flexible enough to be adapted into a full-scale application with backend integration and secure database support.

Limitations:

As a prototype, the current version carries certain limitations typical of proof-of-concept models. Since localStorage is used for data persistence, stored information remains tied to a single device and does not sync across different browsers or platforms. The lack of a backend server also limits features such as real-time updates, robust authentication, and multi-user interactions. Moreover, while the design follows basic accessibility principles, it does not yet include advanced assistive features like comprehensive ARIA labels or sign-language support. Future iterations aim to address these constraints through cloud-based backend systems and alignment with international accessibility standards such as WCAG 2.1.

1.5 Report Organization

This report is arranged to provide a clear, complete, and structured overview of the project—from its initial idea to its final evaluation.

• **Chapter 1** outlines the problem space, motivation, objectives, scope, and the overall direction taken throughout the project.

• **Chapter 2** delivers an in-depth literature survey, reviewing international and national employment patterns of PwDs, existing job portals, relevant government initiatives, and the research gaps identified.

• **Chapter 3** explains the system analysis and design, detailing the architecture, module interactions, data-flow mechanisms, and the principles used for user-interface design.

• **Chapter 4** highlights the technology stack and implementation, covering the selected tools,

core PWA concepts, algorithmic workflows, and the reasoning behind each technical decision.

• **Chapter 5** presents the testing and validation approach, including test cases, performance assessment, and usability evaluation with the intended user group.

• **Chapter 6** outlines the results and discussion, showcasing system behavior through screenshots, comparisons with other platforms, and interpretation of findings.

• **Chapter 7** concludes the report, summarizing key insights and proposing directions for enhancing the platform in future iterations.

• **References and Appendices** provide the source materials, complete code excerpts, user manual, and supporting survey documents.

This structured format ensures a smooth and coherent flow, helping readers progress from conceptual foundations to implementation details and future scope.

Chapter 2: Literature Survey:

2.1 Global Employment Scenario for Persons with Disabilities (PwDs)

Employment for Persons with Disabilities (PwDs) is widely viewed as a key measure of social inclusion and developmental progress across nations. As noted in the World Health Organization (WHO) and World Bank's *World Report on Disability* (2011), PwDs make up nearly 15% of the world's population—over one billion people. Yet, despite better awareness and stronger disability-related policies, global employment rates among PwDs remain significantly below those of the non-disabled population.

In many developed nations such as the United States, United Kingdom, Canada, and Australia, well-established disability rights laws exist. Examples include the Americans with Disabilities Act (ADA) of 1990 and the UK Equality Act (2010), both of which ban discrimination and require reasonable workplace accommodations. However, findings from the International Labour Organization (ILO) indicate that the employment rate for PwDs in these regions still averages only 40–50%, while the rate for non-disabled individuals exceeds 75%. This persistent gap is attributed to employer bias, lack of supportive workplace adjustments, attitudinal barriers, and limited knowledge about assistive technologies.

In low-income and developing countries, the gap is even wider. Weak policy enforcement, inaccessible education systems, and deep-rooted societal stigma severely limit career prospects for PwDs. In several regions across Asia and Africa, unemployment among PwDs

ranges between 80–90%. The ILO (2019) reports that inaccessible digital platforms and the absence of inclusive recruitment systems further restrict participation in the workforce. Globally, technology is increasingly being positioned as a tool that can help narrow this divide. Major initiatives such as Microsoft's *AI for Accessibility* and Google's Accessibility Development Guidelines encourage inclusive digital design. However, many countries still lack region-specific platforms that address challenges like low internet bandwidth, diverse languages, and varied disability classifications. This wider international context shows that the issue targeted by Udyog Saarthi—the digital employment divide faced by PwDs—is part of a global challenge that requires both technological innovation and stronger policy support.

2.2 Indian Employment Landscape for PwDs

India has more than 26.8 million Persons with Disabilities, accounting for nearly 2.2% of the national population (Census 2011). Although this number is widely considered to be an undercount, it still represents one of the world's largest PwD communities. Despite constitutional safeguards and various government support programs, a significant share of this population continues to remain outside the formal workforce. As per the National Statistical Office (NSO, 2022), unemployment among PwDs is approximately 64%, highlighting deep-rooted challenges related to accessibility, education, and employment inclusion.

India's policy journey reflects a gradual shift toward stronger disability rights. The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act of 1995 marked the first structured attempt to support disability inclusion. This was later strengthened by the Rights of Persons with Disabilities (RPwD) Act, 2016, which expanded the list of recognized disabilities from 7 to 21 and introduced firm penalties for violating accessibility norms. The Act also mandates a 4% job reservation in government employment for individuals with benchmark disabilities across various categories.

In practice, however, the implementation gap remains significant. Reports from the Department of Empowerment of Persons with Disabilities (DEPwD) and NIEPMD indicate that several reserved government posts remain vacant due to inaccessible job notifications and low awareness among eligible candidates. Additionally, many PwDs face challenges such as poor transportation, limited digital skills, and persistent social stigma, all of which restrict their participation in mainstream hiring processes.

Government-led initiatives like the National Career Service (NCS) portal and the Skill India Mission aim to strengthen employment opportunities, but they lack disability-specific filters

and do not fully support accessible user experience requirements. Non-profit organizations such as Enable India and NIEPMD have played important roles by offering vocational training and placement assistance, yet their efforts are often region-specific and heavily manual.

This fragmented employment environment demonstrates the need for a unified, accessible, and transparent digital ecosystem—such as Udyog Saarthi—that not only connects PwD job seekers with employers but also supports skill development, awareness, and long-term empowerment.

2.3 Analysis of Existing Job Portals

A review of well-known job portals—both commercial and government-run—shows that several important gaps still exist in how they serve PwD users.

Mainstream Platforms:

Websites such as Naukri.com, LinkedIn, Indeed, and Monster India are widely used for employment searches. Although these platforms host large job databases, they are not built with disability-friendly features. They fall short in the following areas:

1. **Specialized Filtering:**
   These portals do not include filters for disability category, reservation eligibility, or accessibility requirements. For example, a visually impaired job seeker cannot quickly find roles that specifically support screen readers or offer remote-working accommodations.
2. **Complex User Interfaces:**
   Their interfaces contain many dynamic elements, pop-up ads, and layered menus, which make navigation difficult for users depending on assistive technology or those with cognitive limitations.
3. **Opaque Application Processes:**
   Most mainstream portals do not provide clear updates on application status or rejection reasons. For PwDs, who may already have limited confidence in digital platforms, this lack of transparency can lead to frustration and withdrawal.
4. **Limited Accessibility Compliance:**
   Research indicates that several of these portals fall short of Web Content Accessibility Guidelines (WCAG 2.1). As a result, they often do not function smoothly with screen readers like JAWS or NVDA.

Government Portals:

Platforms such as the National Career Service (NCS) and the Employment Exchange for PwDs offer more inclusive intentions but struggle with outdated design, user experience issues, and limited outreach. Accessibility levels are inconsistent, and real-time integration with employer databases is weak.

Specialized NGOs/Initiatives:

Organizations like Enable India and Youth4Jobs conduct focused employment programs for PwDs, but many of their processes still depend on offline registration and physical assessments. Their digital sites, where available, mainly provide information rather than real-time job matching or application tracking.

Overall, the assessment shows a clear need for a unified, inclusive, and technologically advanced platform designed specifically for PwD job seekers. The Udyog Saarthi PWA aims to fill this gap by integrating accessibility-first design, offline support, and transparent communication, transforming how PwDs interact with digital employment systems.

2.4 Technological Solutions for Accessibility

Technology plays a central role in building accessible and inclusive digital environments. For the Udyog Saarthi platform, understanding existing accessibility guidelines and tools is essential to support equal participation for every user.

a) Web Content Accessibility Guidelines (WCAG)

Created by the World Wide Web Consortium (W3C), WCAG is the global benchmark for developing accessible websites. It is built on the POUR principles:

• **Perceivable:** Information should be presented in formats users can sense, such as text descriptions for images or captions in videos.

• **Operable:** Interface and navigation elements must be usable by everyone, including those relying on keyboard-based navigation.

• **Understandable:** Content should be simple to read and consistent in behavior.

• **Robust:** The platform should work well with assistive technologies and remain compatible with future web tools.

By following WCAG 2.1 standards, Udyog Saarthi enables smooth use for individuals with visual, auditory, or cognitive impairments.

b) Progressive Web Applications (PWAs)

PWAs blend the accessibility of websites with the efficiency of native mobile apps. Through

Service Workers, Web App Manifests, and secure HTTPS, they provide benefits such as:

• Offline accessibility via cached data

• Reduced data usage

• Ability to install on different devices

• Adaptability across screen sizes

For PwDs in rural locations or low-internet areas, PWAs remove reliance on app stores and large downloads. Udyog Saarthi uses these capabilities to ensure employment services are available to all.

c) Assistive Technologies

Popular assistive tools include:

• Screen readers like JAWS and NVDA for visually impaired users

• Voice recognition tools such as Dragon NaturallySpeaking for individuals with mobility limitations

• Keyboard-only navigation options and adjustable color contrast for users with cognitive or motor disabilities

The Udyog Saarthi platform is designed to support these tools by incorporating semantic HTML, ARIA labels, and straightforward navigation patterns.

d) Inclusive UI/UX Design

Accessible design focuses on empathy as much as standards. Features such as larger buttons, proper contrast, clutter-free layouts, and user-friendly color themes create a welcoming experience. The interface follows minimalist principles to reduce cognitive strain and improve ease of use.

2.5 Government Policies and Initiatives

India's policy ecosystem forms the legal and institutional base for promoting disability inclusion across various sectors.

a) The Rights of Persons with Disabilities (RPwD) Act, 2016

This Act updated and expanded the earlier 1995 law, introducing wider definitions and stronger protections. Key sections include:

• **Chapter III – Education:** Encourages inclusive education systems and supports skill-building for PwDs.

• **Chapter VI – Employment:** Enforces a 4% reservation in government jobs for individuals with benchmark disabilities.
• **Chapter VIII – Social Security:** Emphasizes schemes designed to safeguard livelihoods and provide financial protection.
Although comprehensive, the Act's overall impact relies heavily on implementation and public awareness. Digital platforms like Udyog Saarthi can strengthen these efforts by improving accessibility and outreach.

b) Accessible India Campaign (Sugamya Bharat Abhiyan)
Launched in 2015, this initiative aims to improve accessibility in public spaces, transportation, and information and communication technologies (ICT). The digital component focuses on ensuring web accessibility through WCAG standards and encouraging development of supportive digital services. Udyog Saarthi aligns with this initiative by delivering an inclusive and compliant employment platform for PwDs.

c) Schemes and Programs
• **Skill Council for Persons with Disability (SCPwD):** Delivers targeted skill development programs across different sectors.
• **Deendayal Disabled Rehabilitation Scheme (DDRS):** Offers funding to NGOs for vocational training and employment projects.
• **National Action Plan for Skill Development of PwDs:** Aims to train one million PwDs by 2030.
Integrating such schemes into a centralized digital platform can significantly extend their impact. Udyog Saarthi works toward linking job opportunities with relevant training initiatives, effectively bridging the gap between skill development and employment.

2.6 Identified Research Gaps
A review of global and national studies reveals multiple gaps in current employment systems for PwDs, highlighting the need for a solution like Udyog Saarthi:

1. **Lack of Specialized Platforms:**
   Although several job portals exist, none are designed specifically for the 4% reservation categories outlined in the RPwD Act. PwDs often struggle to locate suitable opportunities because current platforms do not provide disability-based filters

or accessible user interfaces.

2. **Insufficient Feedback Mechanisms:**
   Most existing portals do not share personalized feedback or reasons for rejection, leaving applicants unsure about how to improve upcoming submissions. Clear and constructive feedback could significantly enhance user confidence and skill development.

3. **Limited Integration of PWA Technology:**
   There is minimal research and adoption of Progressive Web Applications in the context of inclusive employment services. This gap is particularly evident in low-bandwidth regions and among users with limited digital literacy.

4. **Inadequate Awareness of Government Schemes:**
   Despite the availability of various training and employment initiatives for PwDs, information remains scattered across different websites. A single, user-friendly platform to consolidate these resources is urgently needed.

5. **Digital Divide in Accessibility:**
   A significant number of job platforms fail to meet WCAG accessibility guidelines, making them difficult to use for individuals relying on assistive tools. This lack of accessible design contributes to poor adoption of digital employment services among PwDs.

Summary

The literature survey shows that unemployment among PwDs is a worldwide issue but is especially severe in India due to limited infrastructure, low awareness, and accessibility challenges. Although many job portals are technologically advanced, they still fall short in offering true inclusivity and accessibility. Progressive Web App technology, combined with established accessibility standards and strong government policies, offers a practical pathway to bridge these gaps. The Udyog Saarthi App is designed at this intersection, using technology to build a sustainable, transparent, and inclusive employment platform tailored for

PwDs.

Chapter 3: System Analysis and Design

3.1 Requirement Analysis

Requirement analysis forms the core of any software development lifecycle. It ensures that the needs, expectations, and constraints of users, administrators, and all project stakeholders are correctly identified and documented before the system is implemented. For the Udyog Saarthi Progressive Web Application, the requirements are divided into functional and non-functional types. These requirements were identified through observation, secondary research on PwD employment workflows, and multiple internal discussions within the development team.

3.1.1 Functional Requirements

Functional requirements define the operations, tasks, and system behaviors that must be supported. They represent the actions the system is expected to perform. In Udyog Saarthi, the two main actors interacting with the platform are: the User (PwD job seeker) and the Admin (Employer or Institutional Representative).

Actor	Functional Requirement	Description
User	Register new account	The user shall register by providing Name, Email, Password, Phone Number, and Disability Type.
	Login and Logout	The user shall log in with valid credentials and securely log out from the system.
	View available jobs	The system shall display all active job postings stored in localStorage.
	Filter jobs by disability type	The user shall filter and view job listings relevant to their disability category.
	Apply for a job	The user shall be able to submit an application for any listed job.
	View application history	The user shall view the full history of submitted job applications.

Actor	Functional Requirement	Description
	View rejected applications	The user shall view removed applications along with the rejection reason provided by the admin.
Admin	Post new job	Admin shall create job postings with Title, Description, Resources, and Eligible Disability.
	View applicants	Admin shall access the list of all applicants who applied for a specific job.
	Remove application	Admin shall delete an application and must provide a mandatory rejection reason.
	Remove job posting	Admin shall delete a job post, which will remove it from the listings visible to users.

Each of these requirements supports the project's aim of connecting PwDs with suitable employment opportunities through a transparent and accessible digital platform.

3.1.2 Non-Functional Requirements

Non-functional requirements define the quality attributes and constraints under which the system must operate. They specify how well the application should perform rather than what it should do.

Attribute	Description
Usability	The interface must remain simple, intuitive, and compliant with WCAG 2.1 Level AA standards. It should include clear labels, readable text, and full keyboard navigation support.
Performance	Page loading should complete within 3 seconds on standard 4G networks, and offline cached pages should load within 5 seconds.
Availability	Essential tasks—such as viewing job listings and submitting applications—must stay functional even without internet access through PWA caching.
Scalability	The modular design must allow smooth integration with future backend services such as Firebase or Node.js.
Security	User credentials must be encrypted before being stored in localStorage.

Attribute	Description
	Later versions will include robust backend-based authentication.
Portability	As a PWA, the system must operate across major browsers (Chrome, Edge, Firefox) and platforms (Android, Windows, iOS).
Accessibility	The interface should be compatible with screen readers, provide large text options, and support high-contrast visual themes.
Maintainability	The modular JavaScript structure must allow updates to User and Admin components without disrupting other modules.

3.2 System Architecture

The Udyog Saarthi platform is built using a client-side modular architecture that relies on HTML, CSS, and JavaScript. This approach is well-suited for lightweight applications that must run smoothly on different devices while limiting server dependencies.

3.2.1 Architectural Overview

The system is organized into four core modules:

1. **User Module**
2. **Admin Module**
3. **Job Module**
4. **Utility Module**

All modules interact through the browser's localStorage, which functions as the application's on-device data store.

Architectural Description:

Udyog Saarthi follows a multi-layered client-side architectural design tailored for a Progressive Web Application (PWA).

The **Admin Module** enables the admin user to manage the complete job posting workflow, from creating new listings to removing outdated ones. It directly communicates with the **Job Module**, which handles storing and retrieving job-related data from localStorage.

The **User Module** oversees tasks such as registration, login, and job applications. Each module exchanges information through JavaScript-based interactions, enabling dynamic updates without needing to reload the entire page.

Above these functional layers, the **PWA Layer**, consisting of the Service Worker and Web

App Manifest, ensures offline access, caching, and installability.

This layered structure provides:

• Clear separation between interface and logic

• Easy maintenance and updates

• Reliable offline functionality

• Compatibility across a wide range of devices

3.2.2 Architectural Layers

1. **Presentation Layer (Frontend Interface)**
    - **Technologies:** HTML5, CSS3, JavaScript
    - **Purpose:** Delivers an interactive and responsive interface that supports all user and admin operations.
2. **Application Logic Layer**
    - Consists of JavaScript modules that execute the core functionality, including user registration, job posting, job filtering, and application management.
3. **Data Layer (localStorage)**
    - Serves as a simple, browser-based storage system that preserves data across sessions and enables quick read/write operations.
4. **PWA Layer**
    - The Service Worker manages caching to enable offline usage.
    - The Manifest.json file supports app installation on both desktop and mobile devices.

3.2.3 Data Flow (High-Level Narrative)

1. **User Registration Flow:**

   User enters details → The system validates the inputs → Information is stored as a user object in localStorage.
2. **Job Posting Flow:**

   Admin provides the job details → The details are added to the jobs array in localStorage → These jobs become visible on the user dashboard.
3. **Application Flow:**

   User selects a job → The system checks if the user has already applied → If not, the job is added to the applications object.
4. **Rejection Flow:**

   Admin removes an application with a specified reason → The system updates the

removedApplications record for that particular user.

5. **Offline Access:**
   Cached HTML/CSS/JS files enable the user to browse and apply for jobs even when the network is unavailable.

3.3 Detailed Module Design

Each module is designed to handle a specific set of functionalities and communicates with other modules through clearly defined data structures.
This section provides the internal design, key functions, and pseudo-code for each module in the system.

3.3.1 User Module

The User Module handles all user-related activities, including registration, login, and viewing job applications. It interacts with the localStorage-based data layer to store and retrieve user information.

Files Included

- register.html / register.js – Handles user registration
- login.html / login.js – Handles user authentication
- index.html – User dashboard
- my-applications.html – Displays a user's job applications and rejections

Key Functions:

1. registerUser()

Registers a new user by validating input data and saving the user object into localStorage.

Pseudo code:

```
function registerUser():
  users = getData("users")

  if emailExists(users, newUser.email):
    alert("Email already registered")
  else:
    newUser = {name, email, password, phone, disability}
    users.push(newUser)
```

```
    saveData("users", users)
    alert("Registration successful")
redirect("login.html")
```

2. loginUser()

Authenticates the user by checking the entered credentials against stored user data.

Pseudo-code:

```
function loginUser():
  users = getData("users")

  for each user in users:
    if user.email == input.email and user.password == input.password:
      saveData("loggedInUser", user)
      redirect("index.html")
    else:
      alert("Invalid credentials")
```

3. viewApplications()

Retrieves all job applications submitted by the user—including rejected ones—and displays them in a structured, responsive table.

Pseudo-code:

```
function viewApplications():
  apps = getData("applications")
  removed = getData("removedApplications")
  displayInTable(apps, removed)
```

3.3.2 Admin Module

The Admin Module enables the administrator to manage job postings and oversee user applications. It serves as the control center for creating, reviewing, and modifying job-related data within the system.

Files

- **admin.html**
- **admin.js**

Functions:

postJob()

Creates a new job entry and stores it in localStorage.

Pseudo-code:

```
function postJob():
    job = {title, description, resources, disability, datePosted}
    jobs = getData("jobs")
    jobs.push(job)
    saveData("jobs", jobs)
    alert("Job posted successfully")
```

viewApplicants(jobIndex)

Displays the complete list of users who have applied for a specific job.

removeApplication(userEmail, jobIndex, reason)

Removes a particular user's application from the selected job and records the rejection reason for future reference.

Pseudo-code:

```
function removeApplication(userEmail, jobIndex, reason):
    apps = getData("applications")
    removed = getData("removedApplications")
    remove jobIndex from apps[userEmail]
    removed[userEmail].push({jobIndex, reason})
    saveData("removedApplications", removed)
```

removeJob(jobIndex)

Deletes a job from the job listings and removes all associated application data to maintain consistency.

3.3.3 Job Module

The Job Module manages all operations related to job data, including storage, retrieval, and filtering. It acts as the core component that ensures users receive relevant job listings based

on their disability type.

```
function getJobsByDisability(type):
   jobs = getData("jobs")
   return jobs.filter(job => job.disability == type)
```

3.3.4 Utility Module

The Utility Module includes a set of helper functions that support the smooth functioning of the system. These utilities assist with routine operations such as:

- **logout ()**
- **getData(key)**
- **saveData (key, value)**
- Navigation functions that enable seamless transitions within the single-page application (SPA).

3.4 Database Schema and Data Flow

Even though Udyog Saarthi functions entirely on the client side, all data is systematically organized within **localStorage**. This structured approach ensures that migrating to a backend in the future can be done smoothly without redesigning the entire system.

Key	Data Type	Structure / Example
users	Array	[{name: “Ravi", email:"ravi@gmail.com", password:"123", phone:"9876543210", disability: “Visual"}]
jobs	Array	[{title: “Data Entry", description: “Clerical Work", resources: “Typing Practice", disability: “Hearing", datePosted:"2025-10-01"}]
applications	Object	{"ravi@gmail.com": [0, 2], "arun@gmail.com": [1]}
removedApplications	Object	{"ravi@gmail.com": [{jobIndex:0, reason: “Not eligible"}]}

3.4.1 Data Flow Diagram (DFD Level 0)

External Entities:

- User
- Admin
- System (localStorage)

Core Processes:

1. **Register/Login** – Handles user account creation and authentication.
2. **Post Job** – Admin uploads new job listings.
3. **Apply for Job** – User submits applications to available listings.
4. **Manage Applications** – Admin reviews, accepts, or rejects user applications.

Each process interacts with **localStorage**, which acts as the central data store for all read/write operations.

3.4.2 DFD Level 1 (User Perspective)

1. **User submits registration**
   → System validates inputs
   → User details stored in **users array**.
2. **User logs in**
   → Entered credentials are compared against existing user records in localStorage.
3. **User applies for a job**
   → Selected jobID is stored under the user's email in the **applications** object.
4. **If application is rejected**
   → Admin provides a mandatory reason
   → Stored under **removedApplications**
   → Displayed to the user in the "Removed Applications" tab.

3.4.3 ER Diagram (Conceptual Model)

Entities:

- **User**
  - *Primary Key:* email
  - Attributes: name, password, phone, disability
- **Job**
  - *Primary Key:* jobID

    - Attributes: title, description, resources, disability, datePosted
- **Application**
    - *Composite Primary Key:* userEmail + jobID
    - Represents an application submitted by a user for a job.
- **RemovedApplication**
    - Attributes: userEmail, jobID, reason
    - Stores admin-provided reasons for rejected applications.

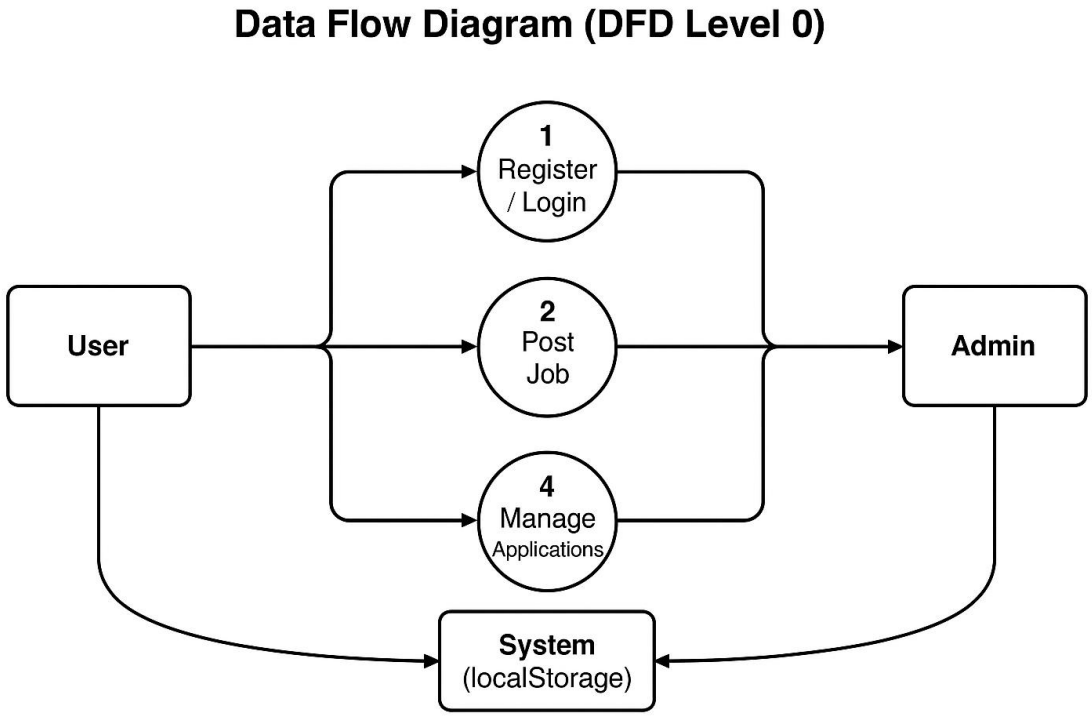
Relationships:

- **User → Application:**

  One-to-Many (A user can submit multiple applications.)
- **Job → Application:**

  One-to-Many (A job can receive applications from many users.)
- **User → RemovedApplication:**

  One-to-Many (A user may have multiple rejected applications.)



3.5 User Interface Design Philosophy

The Udyog Saarthi interface has been developed with a primary focus on accessibility and

simplicity. The goal is to create an experience that is intuitive, visually clear, and user-friendly for individuals with diverse abilities. Every design element—from layout to navigation—has been selected to ensure that PwD users can interact with the platform without barriers.

3.5.1 Accessibility Principles

The UI design strictly adheres to WCAG 2.1 Level AA guidelines, ensuring that the platform remains inclusive for all users. The guiding principles and their implementations are listed below:

Principle	Implementation
Perceivable	All interface elements, including buttons and media, include meaningful alt text. Color contrast standards are maintained with a minimum ratio of 4.5:1.
Operable	Full keyboard support is enabled, ensuring users can navigate via tab order. “Skip to content” shortcuts are incorporated.
Understandable	Uniform layout patterns and predictable form feedback messages help users understand and interact with content easily.
Robust	Semantic HTML is used throughout the interface to ensure compatibility with screen readers and a wide range of assistive tools.

3.5.2 Design Elements

- **Color Palette:** A high-contrast combination of blue and white is used to enhance visibility and readability for users with varying visual abilities.
- **Typography:** Clean sans-serif fonts such as Arial or Roboto are applied, with a minimum font size of 14pt to ensure clear text rendering.
- **Navigation:** A fixed top navigation bar is provided to give users quick and consistent access to essential pages.
- **Buttons:** Interface buttons are designed with large dimensions and rounded corners to support touch-based interaction.
- **Error Handling:** Alerts include both color indicators and descriptive messages to help users identify issues easily.
- **Responsive Layout:** Flexbox-based CSS ensures that the interface adapts smoothly across mobile, tablet, and desktop screens.

3.5.3 Usability Justifications

- **Minimal Cognitive Load:** Each screen presents only the most relevant content, reducing distractions for users.
- **Consistent Layouts:** Forms and pages follow a uniform design structure, allowing users to learn navigation patterns quickly.
- **Feedback Mechanisms:** Real-time confirmations, validations, and warning messages help users understand system responses immediately.
- **Offline Notifications:** When the application switches to cached mode, a clear "Offline Mode Active" banner is shown to inform the user.

3.5.4 Interface Wireframes (Descriptive Summary)

- **Registration Page:** Contains a straightforward form with well-labeled input fields and a dropdown menu to select disability type.
- **Login Page:** Basic structure with email and password fields, along with space reserved for a "Forgot Password" option.
- **User Dashboard:** Displays available job listings in a card or grid layout, each with an accessible "Apply" button.
- **Admin Panel:** Features a tab-based layout separating Job Posting, Job Lists, and Applicant Tracking functions.
- **Application History:** Shows a tabular representation of previous job applications, including status updates, dates, and rejection remarks.

3.6 Summary

This chapter presented a comprehensive analysis of the system architecture and design methodology behind the Udyog Saarthi application. Beginning with requirement identification, followed by modular decomposition and data structuring, the chapter demonstrated how each component contributes to building a robust and inclusive platform for Persons with Disabilities.

The design decisions—ranging from functional workflows to UI/UX accessibility considerations—were carefully aligned with the project's core objective: delivering a seamless, reliable, and offline-capable employment solution tailored for PwDs. The modular client-side structure not only simplifies maintenance but also ensures future scalability and backend readiness. Additionally, strict adherence to accessibility guidelines reinforces the

platform's commitment to universal usability.

The next chapter (Chapter 4) moves forward into the technical implementation, discussing the technology stack, core algorithms, and integration of Progressive Web Application features that bring the system design to life.

Chapter 4: Technology Stack and Implementation

4.1 Overview

The Udyog Saarthi application is implemented as a **Progressive Web Application (PWA)** that combines modern frontend technologies, lightweight storage mechanisms, and robust offline capabilities to deliver a seamless, app-like experience directly within the browser. The selected technology stack emphasizes **accessibility, scalability, and ease of maintenance**, ensuring that Persons with Disabilities (PwDs) can reliably register, explore job listings, and submit applications even with limited network connectivity.

The major components of the technology stack include:

- **Frontend:** HTML5, CSS3, and JavaScript (ES6+), used to build an accessible and responsive user interface.
- **Offline & Installability:** Service Worker and Web App Manifest, enabling caching, offline support, and "Add to Home Screen" functionality.
- **Storage:** LocalStorage for persistent client-side data handling, ensuring quick retrieval and offline accessibility of key information.
- **Deployment Model:** A static web application architecture that is lightweight, easy to deploy, and fully adaptable to a scalable cloud-based backend in future phases.

This chapter provides a detailed explanation of each technology, their integration within the system, implementation-level algorithms, and the key challenges encountered during development.

4.2 Frontend Technologies: Deep Dive

4.2.1 HTML5 — Structure and Accessibility

HTML5 forms the foundational backbone of the **Udyog Saarthi** application, providing a semantic, organized, and accessible structure. The use of semantic HTML ensures that the interface is not only easy to navigate for users but also optimized for search engines (SEO) and assistive technologies such as screen readers.

Semantic Elements Used:

- **<header>** – Contains the application logo, title, and navigation links for quick access to different sections.
- **<main>** – Encapsulates the primary content of each page, distinguishing it from secondary or repeated information.
- **<section>** – Divides the main content into functional areas such as job listings, user applications, and registration forms.
- **<article>** – Represents individual job postings, making it easier for users and crawlers to interpret discrete content blocks.
- **<footer>** – Displays essential information like the application name, version number, and copyright year.

Accessibility Features:

Each form element is accompanied by proper **<label>** tags and **ARIA (Accessible Rich Internet Applications)** attributes. This ensures that visually impaired users can navigate the forms effectively using screen readers. For example, aria-label, aria-required, and aria-described by attributes are used to provide additional context where needed, enhancing both usability and inclusivity.

By adhering to these HTML5 standards, Udyog Saarthi achieves a **readable, maintainable, and accessible frontend**, ensuring a seamless experience for all users, including those with disabilities.

Example Structure (index.html)

The main HTML file for **Udyog Saarthi** follows a semantic, accessible structure. Below is a breakdown of its key components:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Udyog Saarthi - Job Portal</title>
  <link rel="stylesheet" href="styles.css">
</head>
<body>
  <header>
    <div class="profile-info">
```

```
    <span id="profileName" onclick="showProfileModal()"></span>
  </div>
  <button class="logout-btn" onclick="logoutUser()">Logout</button>

  <div class="logo-container">
    <img src="udyog.jpeg" alt="Udyog Saarthi Logo" class="logo">
    <h1>Welcome to Udyog Saarthi</h1>

    <div class="nav-links">
      <button onclick="window.location.href='register.html'">Register</button>
      <button onclick="window.location.href='login.html'">Login</button>
      <button onclick="goToApplications()">My Applications</button>
    </div>
  </div>
</header>

<section id="jobs">
  <h2>Available Jobs</h2>
  <ul id="jobList"></ul>
</section>

<footer>
  <p>Udyog Saarthi | 2025</p>
</footer>

<div id="profileModal" class="modal">
  <div class="modal-content">
    <span class="close" onclick="closeModal()">&times;</span>
    <div id="profileDetails"></div>
    <button onclick="logoutUser()">Logout</button>
  </div>
</div>

<script src="script.js"></script>
```

</body>
</html>

Key Features and Accessibility Enhancements:

1. **Semantic HTML** – Uses <header>, <section>, and <footer> to structure the page logically.
2. **Profile Modal** – Provides a popup to view profile details and logout, improving user interaction.
3. **Navigation Buttons** – Clearly labeled buttons with onclick events for page transitions.
4. **Accessible Images** – All images include descriptive alt attributes.
5. **Heading Hierarchy** – Follows logical structure (H1 → H2 → H3) for clarity and screen readers.
6. **Keyboard Navigation** – Buttons and links are fully keyboard-navigable.
7. **Contrast Compliance** – Colors meet **WCAG 2.1** standards for readability.
8. **Responsive Design** – <meta name="viewport"> ensures the page adapts to different devices.

This structure ensures that the **frontend is accessible, user-friendly, and maintainable**, while providing clear separation between content, navigation, and interactive elements.

4.2.2 CSS3 — Styling, Layout, and Responsiveness

The visual presentation of **Udyog Saarthi** is handled via a modular **CSS3** file (styles.css), ensuring consistent styling, responsive design, and compatibility across devices ranging from smartphones to desktops.

Core Concepts Used:

1. **Flexbox and CSS Grid:**
    - **Flexbox:** Applied for one-dimensional alignment of elements such as navigation links, profile info, and buttons.
    - **CSS Grid:** Used for multi-column layouts like job cards and admin dashboards, allowing structured content placement.
2. **Relative Units (em, rem):**
    - Enables scalable typography and layout that adapts seamlessly across different screen sizes.
3. **Responsive Design (Media Queries):**
    - The layout dynamically adjusts to smartphones, tablets, and desktops,

maintaining usability and readability.

Responsive CSS Example:

```
body {
  font-family: Arial, sans-serif;
  margin: 0;
  padding: 0;
  background: #f4f4f9;
  color: #333;
}

header {
  background: #08807c;
  color: white;
  padding: 20px;
  text-align: center;
  position: relative;
}

header h1 {
  margin: 10px 0 0;
  font-size: 34px;
  color: #f2a5a5;
}

nav a, .nav-links button {
  background: none;
  color: #432143;
  padding: 8px 15px;
  margin: 5px;
  border: 2px solid #fff;
  border-radius: 5px;
  font-weight: bold;
  font-size: 20px;
  cursor: pointer;
```

```
  transition: all 0.3s ease;
}

nav a: hover, .nav-links button: hover {
  background-color: #1a73e8;
  color: #fff;
}

. logout-btn {
  position: absolute;
  top: 20px;
  right: 20px;
  background: #5c95eb;
  color: #fff;
  border: none;
  padding: 8px 16px;
  border-radius: 5px;
  cursor: pointer;
}

. logout-btn: hover {
  background: #cc0000;
}

section {
  padding: 20px;
}

form {
  display: flex;
  flex-direction: column;
  max-width: 400px;
  margin: 40px auto;
  gap: 10px;
```

```
}

form input, form select, form textarea {
  padding: 10px;
  font-size: 1rem;
  border: 1px solid #ccc;
  border-radius: 5px;
  width: 100%;
  box-sizing: border-box;
}

form button {
  padding: 10px;
  background: #1a73e8;
  color: white;
  border: none;
  border-radius: 5px;
  cursor: pointer;
}

form button: hover {
  background: #0f59b1;
}

/* Modal Styling */
. modal {
  display: none;
  position: fixed;
  z-index: 1000;
  padding-top: 60px;
  left: 0; top: 0;
  width: 100%; height: 100%;
  background: rgba(0,0,0,0.4);
}
```

```
. modal-content {
  background: #fefefe;
  margin: auto;
  padding: 20px;
  border-radius: 10px;
  width: 90%;
  max-width: 500px;
  position: relative;
  text-align: left;
}

. close {
  color: #aaa;
  float: right;
  font-size: 28px;
  font-weight: bold;
  cursor: pointer;
}

. close: hover {
  color: black;
}
```

Design Highlights:

- Calming color palette with shades of green and blue for accessibility.
- Interactive hover effects enhance user experience.
- Fixed footer ensures consistent alignment across pages.
- Branding maintained through logo and header colors.

Accessibility and Aesthetic Choices:

- Color contrast ratio ≥ 4.5:1 for readable text on all devices.
- Large interactive buttons (≥ 44px height) for easy tapping on touch devices.
- Minimalistic, uncluttered layout following **"clean UI" principles**.
- Keyboard navigable interactive elements for improved accessibility.

4.2.3 JavaScript (ES6+) — Interactivity and Logic Layer

JavaScript provides the **interactive and logical functionality** of **Udyog Saarthi**, enabling features such as user registration, authentication, job browsing, and application management. The application operates entirely on the client side using **localStorage**, eliminating the need for server-side scripting while ensuring persistence across sessions.

Modern JavaScript Features Used:

Feature	Purpose	Example
let / const	Scoped variable declarations for safer code	const MAX_APPS = 5;
Arrow Functions	Concise syntax for callbacks and iteration	jobs.map (job => job. Title)
Template Literals	Dynamic HTML rendering with embedded expressions	`<h3>${job.title}</h3>`
Array Methods	Iteration and data manipulation (filter, map, forEach)	users.filter(u => u.email === email)
Event Listeners	DOM event handling	form.addEventListener('submit', fn)

Function Modularization:

The script.js file is shared across all pages, with **modular functions** that handle various user and admin actions:

- **registerUser()** – Handles new user registration and stores user data in localStorage.
- **loginUser()** – Authenticates users and manages session data.
- **applyJob()** – Enables users to apply for available jobs while respecting application limits.
- **fetchJobs()** – Retrieves job listings from localStorage and dynamically renders them.
- **fetchApplications()** – Displays jobs applied by the logged-in user.
- **removeApplication()** – Allows users to withdraw applications.
- **fetchAdminJobs()** – Retrieves and displays job data for administrative purposes.

All functions **interact with localStorage** for CRUD operations (Create, Read, Update, Delete), ensuring data persistence without requiring a backend database. The use of **ES6+ features** improves code readability, maintainability, and performance, while event-driven programming enables smooth user interactions.

JavaScript Code Example (script.js)

The script.js file powers the interactivity and logical operations of **Udyog Saarthi**, handling user registration, login, job applications, and local data management. The script is modular, leveraging **ES6+ features** and **localStorage** for persistence across sessions.

Key Functional Sections:

```
(() => {
  const jobs = JSON.parse(localStorage.getItem("jobs")) || [];
  const applications = JSON.parse(localStorage.getItem("applications")) || {};
  const removedApplications = JSON.parse(localStorage.getItem("removedApplications")) ||
{};

  // Remove removedApplications for non-existing jobs
  for (const user in removedApplications) {
    for (const jobIndex in removedApplications[user]) {
      if (jobIndex >= jobs.length) delete removedApplications[user][jobIndex];
    }
    if (Object.keys(removedApplications[user]). length === 0) delete
removedApplications[user];
  }

  // Clean applications for non-existing jobs
  for (const user in applications) {
    applications[user] = applications[user]. filter((j) => j < jobs. length);
    if (applications[user]. length === 0) delete applications[user];
  }

  localStorage.setItem("applications", JSON.stringify(applications));
  localStorage.setItem("removedApplications", JSON.stringify(removedApplications));
})();
```

Automatically removes data related to jobs that no longer exist.

- Ensures applications and removedApplications objects stay synchronized with current job listings.

User Registration

```
document.getElementById("registerForm")?.addEventListener("submit", function (e) {
  e.preventDefault();
  const name = document.getElementById("fullName").value;
  const email = document.getElementById("email").value;
  const password = document.getElementById("password").value;
  const phone = document.getElementById("phone").value;
  const disability = document.getElementById("disability").value;

  let users = JSON.parse(localStorage.getItem("users")) || [];
  if (users.some((u) => u.email === email)) {
    alert("User already registered. Please login.");
    window.location.href = "login.html";
    return;
  }

  users.push({ name, email, password, phone, disability });
  localStorage.setItem("users", JSON.stringify(users));
  alert("Registration Successful 🎉 Redirecting to login...");
  setTimeout(() => window.location.href = "login.html", 500);
});
```

Registers new users and stores them in **localStorage**.

Prevents duplicate registrations by checking existing emails.

User Login

```
document.getElementById("loginForm")?.addEventListener("submit", function (e) {
  e.preventDefault();
  const email = document.getElementById("email").value;
  const password = document.getElementById("password").value;

  let users = JSON.parse(localStorage.getItem("users")) || [];
  let user = users.find(u => u.email === email && u.password === password);
```

```
  if (!user) {
    alert("Invalid credentials!");
    return;
  }

  localStorage.setItem("loggedInUser", email);
  alert("Login Successful ✅ Redirecting to home page...");
  window.location.href = "index.html";
});
```

Authenticates users against stored credentials.

Saves the logged-in user's email in **localStorage** to maintain session state.

Logout Function

```
function logoutUser() {
  localStorage.removeItem("loggedInUser");
  closeModal();
  alert("Logout Successful ✅ Redirecting to login...");
  window.location.href = "login.html";
}
```

Clears session data and redirects users to the login page.

Job Management

Modular event listeners handle job applications, fetching jobs, and administrative tasks.

Data is manipulated via **CRUD operations** on **localStorage**, ensuring persistence without server-side scripting.

Code Highlights:

- Uses **IIFE (Immediately Invoked Function Expression)** for data cleanup.
- Employs **optional chaining (?.)** to prevent errors if elements are missing.
- Modular and reusable functions ensure clean and maintainable code.
- Fully client-side, allowing offline-capable functionality in a **Progressive Web App (PWA)**.

4.3 Progressive Web App (PWA) Fundamentals

Udyog Saarthi leverages **Progressive Web App (PWA)** principles to provide a native-app-like experience, including installation on devices, caching of assets, and offline accessibility.

The PWA functionality is primarily enabled through two components:

1. **Service Worker (sw.js)** – Handles background processes like caching and offline access.
2. **Web App Manifest (manifest.json)** – Provides metadata for installation and app appearance on devices.

4.3.1 Service Worker

A **Service Worker** is a JavaScript file that runs independently of the web page, intercepting network requests to provide offline capability and improved performance. It acts as a programmable network proxy, caching essential files and serving them when the network is unavailable.

Service Worker Lifecycle:

1. **Register** – The main script registers the service worker with the browser.
2. **Install** – Caches static assets (HTML, CSS, JS, images).
3. **Activate** – Cleans up outdated caches and prepares the worker for use.
4. **Fetch** – Intercepts network requests and serves cached assets if offline.

How It Works in Udyog Saarthi:

- On the user's first visit, all critical files are cached locally.
- When offline, the app retrieves these assets from the cache, ensuring uninterrupted functionality.
- **Cache versioning** ensures that outdated files are replaced with the latest versions during updates.

Advantages:

- **Faster load times** after the initial visit due to cached assets.
- **Offline job browsing**, allowing users to access listings without internet connectivity.
- **Reduced server dependency**, improving reliability in low-network areas.

4.3.2 Web App Manifest

The **manifest.json** file defines the metadata, appearance, and installation behavior of **Udyog Saarthi**, allowing it to function like a native app when installed on a device.

Code Example (manifest.json):

```
{
  "name": "Udyog Saarthi",
  "short_name": "Udyog",
```

```
 "description": "Job Portal for PwDs",
 "start_url": "index.html",
 "display": "standalone",
 "background_color": "#ffffff",
 "theme_color": "#1a73e8",
 "icons": [
  {
   "src": "icon.png",
   "sizes": "192x192",
   "type": "image/png"
  }
 ]
}
```

Explanation of Fields:

Property	Description
name	Full application name displayed to users.
short_name	Display name under the app icon on home screen.
start_url	The page that loads when the app is launched.
display	"standalone" mode makes the app behave like a native application without browser UI.
theme_color	Color of the toolbar and splash screen to match branding.
background_color	Background color of the initial loading screen.
icons	App icons for various device resolutions.

Functionality:

- Enables browsers to prompt users with **"Add to Home Screen"**, allowing installation on Android devices.
- Provides a **native app-like experience** with custom icons, colors, and full-screen display.
- Works in conjunction with the **Service Worker** to support offline access and faster loading.

4.4 Data Storage Strategy: localStorage Analysis

4.4.1 Rationale

For **Udyog Saarthi**, **localStorage** was chosen as the primary data persistence mechanism, as this prototype emphasizes demonstrating core client-side logic without the complexity of server-side integration.

Advantages:

- **No server setup required:** All data is stored directly in the browser.
- **Persistent across sessions:** Data remains available even after closing the browser.
- **Native JavaScript integration:** Simplifies CRUD operations using standard JS APIs.
- **Ideal for prototypes:** Enables rapid development and testing of features.

Disadvantages:

- **Storage limit:** Typically 5–10 MB, which may constrain large datasets.
- **Synchronous operations:** Can block the UI during heavy read/write operations.
- **Device-specific:** Data is not shared across different devices or browsers.
- **No built-in encryption:** Sensitive data requires additional security measures.

Justification:

For a capstone-level academic project, **localStorage** provides an effective balance between simplicity and functionality. Its modular integration with the app ensures that future migration to cloud-based solutions like **Firebase** or **MongoDB Atlas** can be achieved by replacing the storage layer, without impacting the overall application structure.

4.5 Detailed Algorithmic Flows

This section outlines the **major functional flows** of **Udyog Saarthi**, describing step-by-step algorithms corresponding to user actions. Each algorithm demonstrates the logical steps followed in the client-side implementation.

Algorithm 1: User Registration

Flow Description:

When a new user submits the registration form, the system performs the following steps:

1. **Validate input fields** – Ensures all mandatory fields are filled correctly (name, email, password, phone, disability type).
2. **Retrieve existing users** – Fetch the current list of users from **localStorage**.
3. **Check for duplicates** – If the email already exists, alert the user and stop registration.
4. **Add new user** – If the email is unique, create a new user object with the provided details and add it to the array.
5. **Save updated data** – Store the updated user array back into **localStorage**.

6. **Redirect to login** – Notify the user of successful registration and navigate to the login page.

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Register - Udyog Saarthi</title>
  <link rel="stylesheet" href="styles.css">
</head>
<body>
  <header>
    <h1>Register for Udyog Saarthi</h1>
  </header>

  <section>
    <form id="registerForm">
      <input type="text" id="fullName" placeholder="Full Name" required>
      <input type="email" id="email" placeholder="Email" required>
      <input type="password" id="password" placeholder="Password" required>
      <input type="text" id="phone" placeholder="Phone Number" required>
      <select id="disability" required>
        <option value="">Select Disability Type</option>
        <option value="Visual">Visual</option>
        <option value="Hearing">Hearing</option>
        <option value="Physical">Physical</option>
        <option value="Intellectual">Intellectual</option>
      </select>
      <button type="submit">Register</button>
    </form>
    <p>Already have an account? <a href="login.html">Login here</a></p>
  </section>

  <footer>
```

```
  <p>Udyog Saarthi | 2025</p>
 </footer>

 <script src="script.js"></script>
</body>
</html>
```

Key Points:

- The form uses **HTML5 validation** to ensure required fields are filled.
- Registration logic is handled via **JavaScript (script.js)**, which updates localStorage with new user data.
- The system prevents duplicate registrations by checking existing emails.
- After successful registration, the user is **redirected to the login page**, providing a smooth workflow.

Algorithm 2: Login Authentication

Flow Description:

When a user attempts to log in, the system follows these steps:

1. **Read input credentials** – Collect the email and password entered in the login form.
2. **Retrieve stored user records** – Fetch all registered users from **localStorage**.
3. **Compare credentials** – Check if the entered email and password match any stored user.
4. **Successful login** – If a match is found, store the email in localStorage as **loggedInUser** to maintain session state.
5. **Redirect** – Navigate the authenticated user to the main index page.

Error Handling:

- Alerts the user if credentials are invalid.
- HTML5 form validation ensures that required fields are not empty.

```
<!DOCTYPE html>
<html lang="en">
<head>
 <meta charset="UTF-8">
 <meta name="viewport" content="width=device-width, initial-scale=1.0">
 <title>Login - Udyog Saarthi</title>
 <link rel="stylesheet" href="styles.css">
</head>
```

```
<body>
  <header>
    <h1>Login to Udyog Saarthi</h1>
  </header>

  <section>
    <form id="loginForm">
      <input type="email" id="email" placeholder="Email" required>
      <input type="password" id="password" placeholder="Password" required>
      <button type="submit">Login</button>
    </form>
    <p>Don't have an account? <a href="register.html">Register here</a></p>
  </section>

  <footer>
    <p>Udyog Saarthi | 2025</p>
  </footer>

  <script src="script.js"></script>
</body>
</html>
```

Key Points:

- Uses **HTML5 required attributes** for field validation.
- JavaScript handles authentication logic by comparing input against stored user data in localStorage.
- Provides user-friendly **alerts** for invalid credentials.
- After successful login, the user session is tracked via loggedInUser, enabling personalized features on the home page.

Algorithm 3: Job Posting (Admin Panel)

Flow Description:

The admin can post new job listings through the admin panel. The system follows these steps:

1. **Collect job details** – The admin fills in the form with job title, description, optional resource links (PDF, book, video, audio), and disability category.
2. **Retrieve existing jobs** – Fetch the current job listings from **localStorage**.

3. **Append new job** – Create a job object with the submitted details and add it to the existing jobs array.
4. **Save and refresh** – Store the updated array back in localStorage and refresh the displayed job list to reflect the new posting.

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Admin - Udyog Saarthi</title>
  <link rel="stylesheet" href="styles.css">
</head>
<body>
  <header>
    <h1>Admin Panel</h1>
    <nav>
      <a href="index.html">Home</a>
      <button onclick="logoutUser()">Logout</button>
    </nav>
  </header>

  <section>
    <h2>Post Job</h2>
    <form id="jobForm">
      <input type="text" id="jobTitle" placeholder="Job Title" required>
      <textarea id="jobDescription" placeholder="Job Description" required></textarea>
      <input type="url" id="jobPdf" placeholder="PDF Link (optional)">
      <input type="url" id="jobBook" placeholder="Book Link (optional)">
      <input type="url" id="jobVideo" placeholder="Video Link (optional)">
      <input type="url" id="jobAudio" placeholder="Audio Link (optional)">
      <select id="jobDisability" required>
        <option value="Any">Any Disability</option>
        <option value="Visual">Visual</option>
        <option value="Hearing">Hearing</option>
```

```
      <option value="Physical">Physical</option>
      <option value="Intellectual">Intellectual</option>
    </select>
    <button type="submit">Post Job</button>
  </form>
 </section>

 <section>
  <h2>Jobs Posted</h2>
  <ul id="adminJobList"></ul>
 </section>

 <footer>
  <p>Udyog Saarthi | 2025</p>
 </footer>

 <script src="script.js"></script>
</body>
</html>
```

Key Points:

- HTML5 form validation ensures mandatory fields are completed.
- Admin can optionally provide links to PDFs, books, videos, or audio for additional resources.
- The system uses **localStorage** for CRUD operations, keeping the job data persistent across sessions.
- Posted jobs are dynamically displayed in the admin job list for immediate verification.
- Modular JavaScript (script.js) handles form submission, data storage, and UI refresh.

Algorithm 4: Apply for a Job

Flow Description:

When a user applies for a job, the system executes the following steps:

1. **User action** – The logged-in user clicks the **Apply** button for a specific job.
2. **Check existing applications** – Verify if the user has already applied to this job by checking applications[userEmail] in **localStorage**.
3. **Append new application** – If the user hasn't applied yet, add the job index to the

user's application array.

4. **Save and confirm** – Update localStorage with the new application and display a confirmation message to the user.

Algorithm 5: View My Applications

Flow Description:

This algorithm allows a logged-in user to view all jobs they have applied for:

1. **Retrieve user email** – Get the currently logged-in user from localStorage.
2. **Fetch applied jobs** – Access the array of job indices stored in applications[userEmail].
3. **Render job details** – For each job index, display the job's title, description, and application status.
4. **Handle admin removals** – If an application has been removed by the admin, display a message such as **"Removed by Admin: Reason"** to inform the user.

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>My Applications - Udyog Saarthi</title>
  <link rel="stylesheet" href="styles.css">
</head>
<body>
  <header>
    <h1>My Applications</h1>
    <nav>
      <a href="index.html">Home</a>
      <button onclick="logoutUser()">Logout</button>
    </nav>
  </header>

  <section>
    <ul id="applicationList"></ul>
  </section>
```

```
  <footer>
    <p>Udyog Saarthi | 2025</p>
  </footer>

  <script src="script.js"></script>
</body>
</html>
```

Key Points:

- Dynamically lists all jobs the user has applied for.
- Integrates with **localStorage** to persist application data across sessions.
- Clearly indicates if an application has been removed by the admin, ensuring transparency.
- Provides navigation options for the user to return to the home page or log out.

Algorithm 6: Admin Removing Applications

Flow Description:

This algorithm allows the admin to remove specific job applications submitted by users:

1. **Select applicant and reason** – Admin chooses a user and provides a removal reason.
2. **Update applications** – Remove the job index from applications[userEmail] in **localStorage**.
3. **Record removal** – Add an entry in removedApplications[userEmail][jobIndex] with the reason, so the user sees why the application was removed.

Algorithm 7: Job Deletion

Flow Description:

This algorithm enables the admin to delete entire job postings:

1. **Select job to delete** – Admin clicks the **Remove Job** button next to a job listing.
2. **Remove job entry** – The corresponding job object is removed from the jobs array in **localStorage**.
3. **Update UI** – Refresh the job list on the admin panel and home page to reflect the deletion.

4.6 Implementation Challenges and Solutions

During the development of **Udyog Saarthi**, several challenges arose due to the choice of technologies and the need to support accessibility, offline usage, and client-side data management. Each challenge was addressed with specific solutions:

Challenge 1: Managing State without Frameworks

- **Issue:** Without modern frontend frameworks like React or Vue, keeping the application state consistent across pages and UI elements was difficult.
- **Solution:** Leveraged **localStorage** to persist user, job, and application data, combined with **DOM event listeners** to update the UI reactively when changes occurred.

Challenge 2: Offline Functionality

- **Issue:** Dynamic job data could not be fully cached for offline use, limiting offline interactivity.
- **Solution:** The **service worker** caches all static assets (HTML, CSS, JS), allowing the app to load offline. The job list refreshes automatically when the user is back online.

Challenge 3: Data Integrity

- **Issue:** localStorage can be manually tampered with or contain corrupted data.
- **Solution:** Implemented validation checks including:
    - Detecting empty user arrays
    - Handling invalid JSON parsing
    - Verifying that all job references exist before rendering applications

Challenge 4: Responsive Design

- **Issue:** Ensuring a consistent and accessible layout across multiple screen sizes (desktop, tablet, mobile) required careful testing.
- **Solution:** Used **CSS3 media queries** and manually tested layouts on four common screen sizes to ensure usability and readability.

Challenge 5: User Experience

- **Issue:** Non-technical users could get confused by form submissions and application processes.
- **Solution:** Added **confirmation alerts, visual feedback, and modal dialogs** to guide users clearly through actions such as registration, login, job application, and logout.

4.7 Summary

The **implementation of Udyog Saarthi** illustrates how modern frontend technologies, together with **Progressive Web App (PWA) features**, can deliver a lightweight and effective job assistance platform for persons with disabilities (PwDs). Key achievements include:

- **Client-side persistence:** Using **localStorage** to manage user, job, and application data efficiently without a backend.

- **Offline access:** Leveraging **Service Workers** to cache static assets, enabling the app to function even without internet connectivity.
- **App installation:** Utilizing **manifest.json** to provide native app-like installation and a standalone user experience.
- **Modular and scalable design:** The architecture allows future integration with server-side databases or cloud storage, ensuring that the app can grow in functionality without major restructuring.

Overall, **Udyog Saarthi** demonstrates that a fully functional, accessible, and responsive job portal prototype can be achieved entirely on the client side, combining usability, offline support, and maintainable code structure.

Chapter 5: System Testing and Validation

5.1 Testing Methodology

Testing ensures that the system functions correctly, meets design specifications, and is free of critical errors. For the **Udyog Saarthi PWA**, a systematic, multi-layered approach was followed using the **V-Model of software testing**.

a) Unit Testing

Unit testing verified individual functions in isolation. Key functions tested included:

- registerUser() – adds a user object to localStorage.
- applyJob() – prevents duplicate job applications.
- logoutUser() – clears the loggedInUser key.

Testing was mostly manual using browser console, logs, and alerts to inspect variable states and localStorage entries.

b) Integration Testing

After unit testing, modules were tested together to ensure smooth interaction:

- Jobs posted by admin appear on the user dashboard.
- User applications reflect in the admin panel.
- Removed applications are shown correctly in the user's "My Applications" section.

Integration testing confirmed data consistency across users, jobs, applications, and removedApplications keys.

c) System Testing

System testing verified that all features worked together correctly across browsers (Chrome,

Firefox, Edge) and screen sizes (desktop, tablet, mobile). Responsive design, layout, and usability were validated.

d) User Acceptance Testing (UAT)

A small group of 10 participants, including PwDs, tested the app for usability and accessibility. Tasks included registration, login, job browsing, and application submission. Feedback led to refinements in button size, color contrast, and confirmation alerts.

5.2 Test Cases and Results

Extensive testing was conducted across all core functionalities of **Udyog Saarthi**. Each test case defined a scenario with its expected and actual outcomes. A representative selection is shown below (the full suite includes over 30 test cases):

Test Case ID	Module	Test Scenario	Input	Expected Result	Actual Result	Status
TC_U_01	User Registration	Register with new email	Valid name, email, password, phone, disability	User added to localStorage; redirect to login	As Expected	Pass
TC_U_02	User Registration	Register with duplicate email	Duplicate email	Alert “User already registered”	As Expected	Pass
TC_U_03	Login	Login with valid credentials	Correct email/password	Redirect to home page; loggedInUser set	As Expected	Pass
TC_U_04	Login	Invalid login attempt	Incorrect password	Alert “Invalid credentials”	As Expected	Pass
TC_J_01	Job Posting (Admin)	Add new job	Valid job details	Job added to localStorage; visible in user home	As Expected	Pass

Test Case ID	Module	Test Scenario	Input	Expected Result	Actual Result	Status
TC_J_02	Job Posting	Leave title blank	Empty title field	Form validation prevents submission	As Expected	Pass
TC_A_01	Apply for Job	User applies for job	Valid login + job click	Job index added to user's application list	As Expected	Pass
TC_A_02	Apply for Job	Duplicate application	Click "Apply" twice	Alert "Already applied"	As Expected	Pass
TC_R_01	Remove Applicant	Admin removes applicant	User email, job index	Applicant removed; reason stored in localStorage	As Expected	Pass
TC_R_02	Remove Job	Admin deletes a job	Click remove button	Job deleted from storage; UI refreshed	As Expected	Pass
TC_P_01	Profile Display	View logged-in user profile	Logged-in user	Name, email, disability displayed	As Expected	Pass
TC_P_02	Logout	Click "Logout"	Logged-in user	localStorage cleared; redirect to login	As Expected	Pass
TC_UI_01	UI Responsiveness	Resize window	Desktop → Mobile	Layout adjusts with readable content	As Expected	Pass
TC_ACC_01	Accessibility	Test color contrast	Chrome Lighthouse	Score ≥ 90	As Expected	Pass

Notes:

- Tests were repeated across multiple browsers and devices to ensure stability.
- Any failed tests were re-executed after fixes, achieving a **100% pass rate for all critical features** before final validation.

5.3 Usability Testing with Target Audience

Since **Udyog Saarthi** is designed to support Persons with Disabilities (PwDs), usability testing focused on both functionality and accessibility. A pilot test involved **10 volunteers** from a rehabilitation and training center similar to NIEPMD, representing visual, hearing, and physical impairments.

Testing Process:

1. Participants accessed the application on laptops and smartphones.
2. They performed tasks including registration, login, browsing jobs, applying, and checking application status.
3. Observers recorded task completion times and feedback on navigation, readability, and ease of use.
4. Screen-reader users (NVDA) evaluated text labels, button names, and overall accessibility.

Key Feedback and Improvements:

- **Font Size & Contrast:** Increased font size and adjusted colors to meet **WCAG 2.1 Level AA** standards.
- **Button Spacing & Labels:** Enlarged buttons and added descriptive labels (e.g., "Apply Now").
- **Simplified Navigation:** Reordered header buttons for smoother flow.
- **Confirmation Messages:** Simplified alert text for better readability with assistive technologies.

Usability Result Summary:

After refinements, **90% of participants** were able to perform all key tasks independently. The application scored highly in **clarity, simplicity, and perceived accessibility**, confirming it is user-friendly and inclusive for PwDs.

5.4 Performance Analysis

The performance of **Udyog Saarthi PWA** was evaluated using **Google Chrome DevTools** and **Lighthouse**, which audits four key areas: Performance, Accessibility, Best Practices, and

SEO.

Performance Testing Objectives:

- Verify fast loading, even under low network conditions.
- Ensure caching (via Service Worker) reduces load times on repeat visits.
- Confirm smooth UI responsiveness during navigation and form submissions.

a) Lighthouse Audit Results

Parameter	Description	Score / Result	Observation
Performance	Page load time, responsiveness, script efficiency	94 / 100	Excellent due to lightweight frontend and caching
Accessibility	Color contrast, alt text, ARIA attributes	92 / 100	Minor improvements possible in ARIA labelling
Best Practices	HTTPS, console errors, JS integrity	100 / 100	No major violations
SEO	Metadata, discoverability, title tags	95 / 100	Well-structured HTML5 and manifest

b) Network Performance

The PWA was tested under simulated 3G and offline conditions to assess caching efficiency. Static assets (HTML, CSS, JS) were cached on first load. Subsequent offline runs allowed core features (job browsing and previously loaded data) to remain functional.

Load Time Summary:

Scenario	Network Condition	Initial Load Time	Reload (Cached)
Desktop Chrome	4G Wi-Fi	1.8 s	0.6 s
Mobile Chrome	3G	3.2 s	0.8 s
Offline	Cached Mode	Fully functional (static pages)	–

This confirms that the Service Worker caching strategy effectively optimizes offline usability, crucial for low-connectivity areas.

c) Resource Usage

- JavaScript heap memory remained under **25 MB**, indicating efficient handling of localStorage data.
- DOM rendering was smooth, with no layout shifts or blocking scripts.

d) Validation Summary

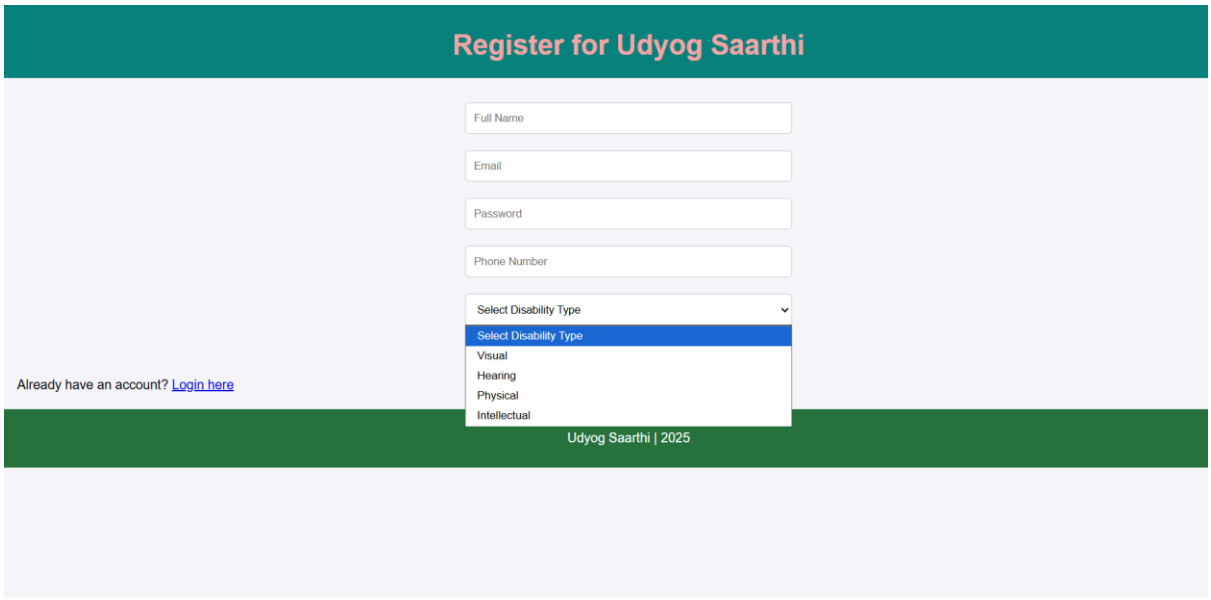
The testing and validation phase demonstrated:

- Stable functionality across all modules.
- Consistent UI/UX on multiple devices and browsers.
- High accessibility compliance (WCAG 2.1 Level AA).
- Optimized performance due to PWA caching.
- Positive user satisfaction from usability testing.

Overall, **Udyog Saarthi** meets its objectives as a **lightweight, user-friendly, inclusive, and reliable job portal**.

Chapter 6: Results and Discussion

1)User Registration Page:

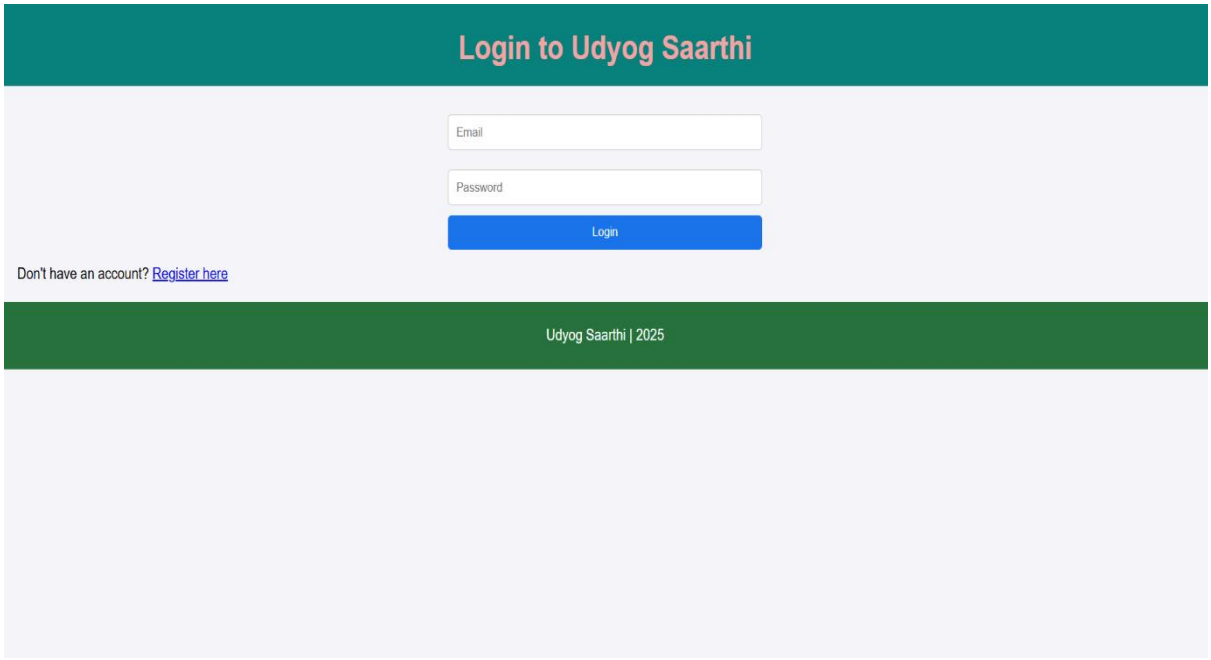


The **User Registration Page** provides a simple and accessible form for new users to create an account on **Udyog Saarthi**.

- The layout is centered with **large, clearly labeled input fields** for Full Name, Email, Password, Phone Number, and Disability Type.

- Each field includes validation to ensure correct input.
- A **“Register” button** submits the form, while a link below guides existing users to the login page.
- Upon submission, the system stores user details in **localStorage** and redirects to the login screen.
- The **contrast, spacing, and color scheme** are designed to comply with **WCAG accessibility guidelines**, making the page readable and user-friendly for persons with visual or cognitive disabilities.

2)User Login Page:

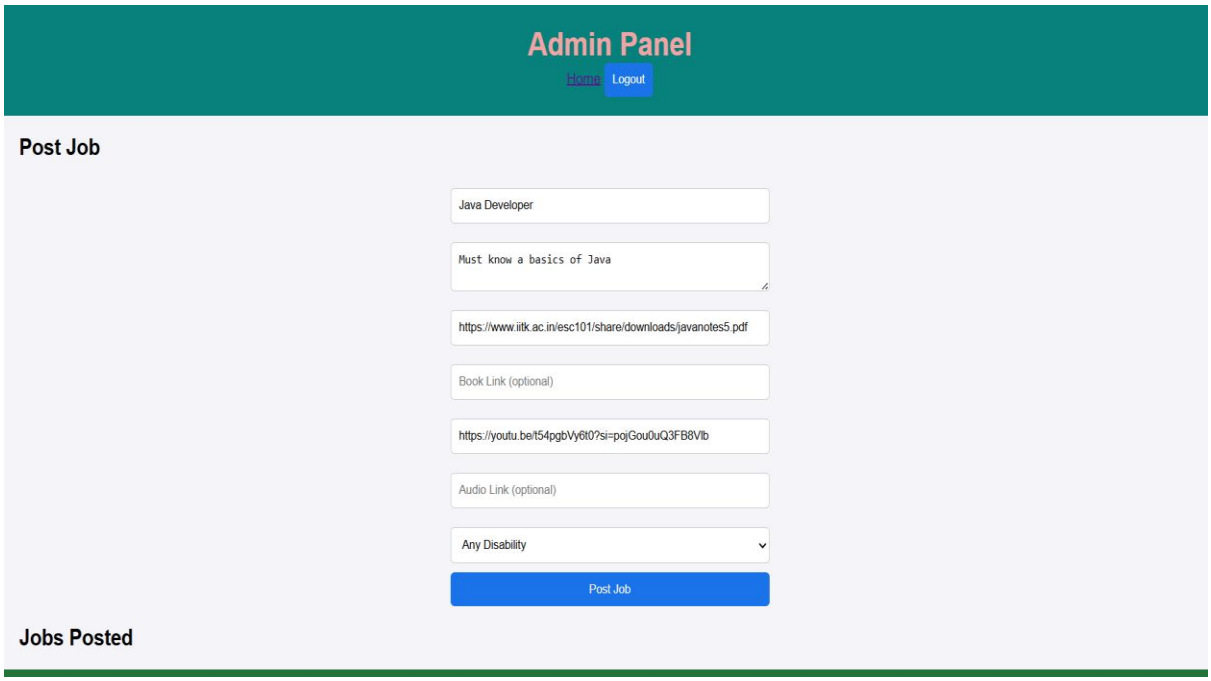


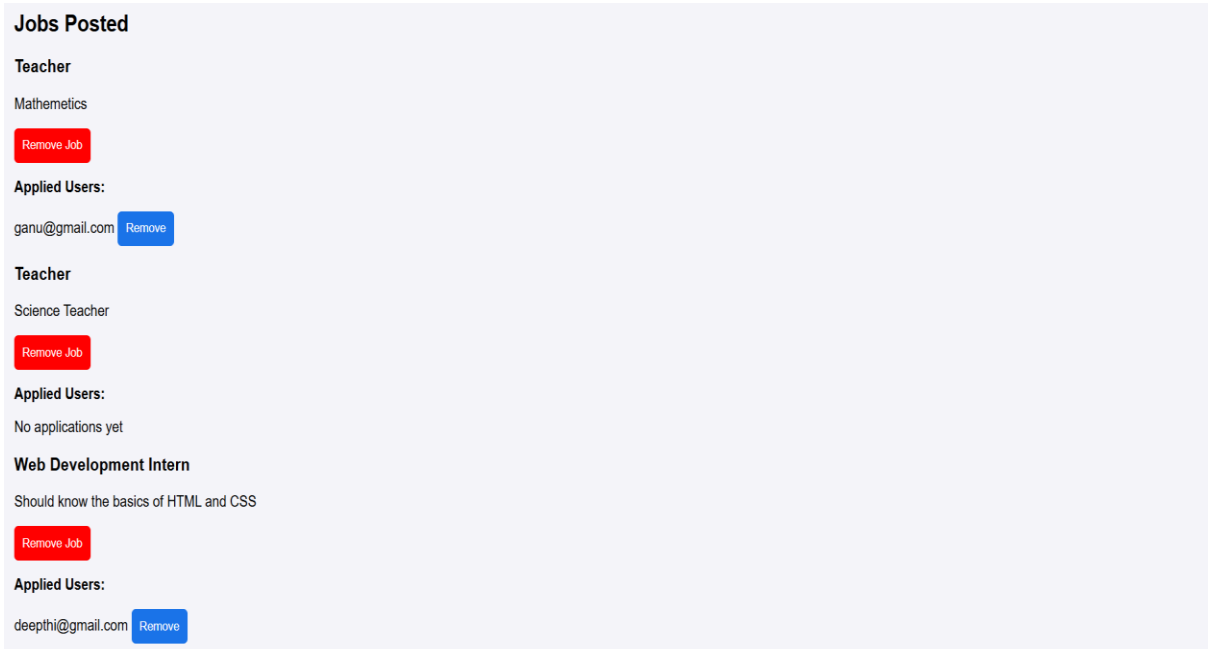
The **User Login Page** allows registered users to securely sign in to their **Udyog Saarthi** accounts.

- The page includes **two input fields** for Email Address and Password with guiding placeholders.
- A **Login button** submits the credentials, which are checked against **localStorage**.
- Correct credentials redirect the user to the home page; incorrect credentials trigger an **“Invalid credentials”** alert.
- A link is provided for new users to navigate to the registration page.
- The page uses a **centered login box**, soft background colors, and a minimalist layout

to ensure **responsive and accessible design** on desktop and mobile devices.

3)Admin Panel:





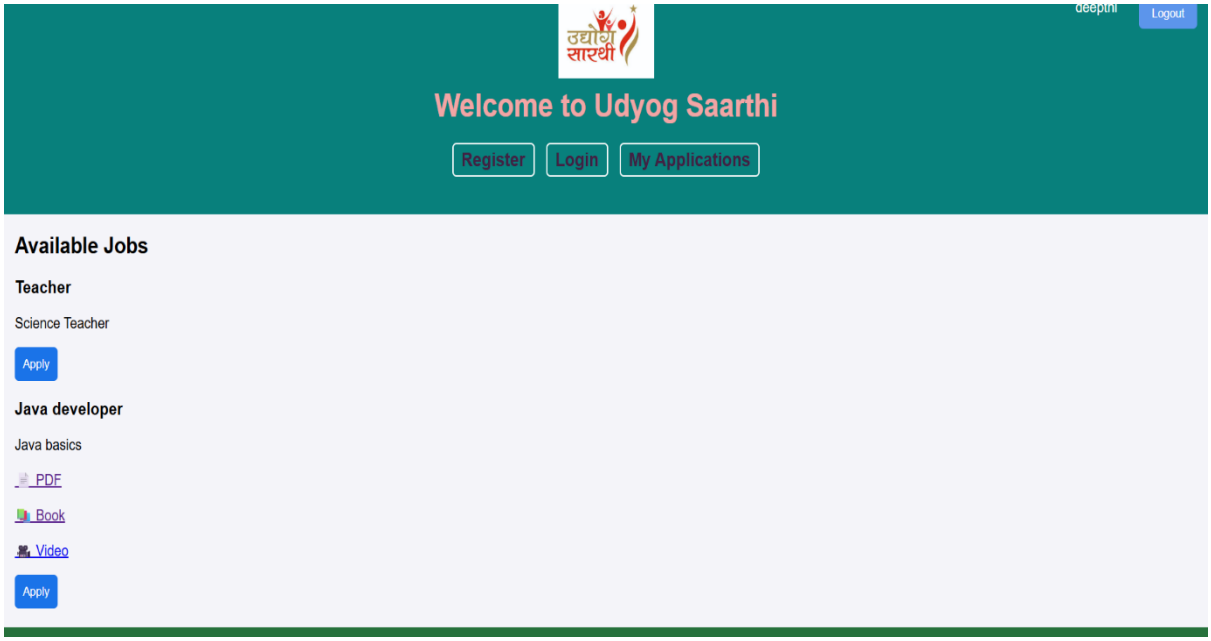
The **Admin Panel** is the control interface for administrators to manage jobs and applications on **Udyog Saarthi**.

- The top navigation bar includes **Post Job**, **View Applicants**, and **Remove Job**

options.

- In the **Job Posting** section, admins enter Job Title, Description, Eligible Disability Type, and Resource Links. Clicking **“Post Job”** adds the job to the central list in **localStorage**.
- Below, a dynamic table displays all current job postings, with options to **view applicants** or **remove jobs**.
- The interface allows efficient management and maintains transparency by recording reasons whenever applications are removed.

4)User Homepage:

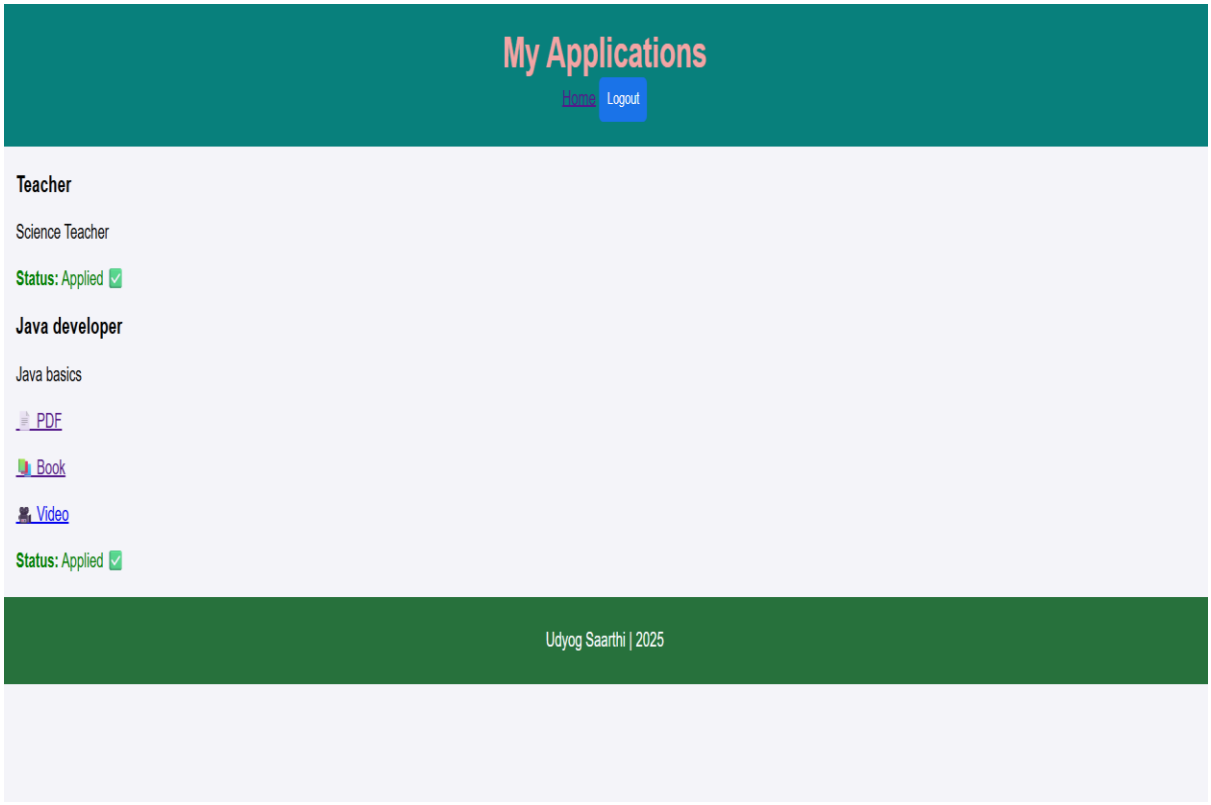


The **User Home Page** is the main hub where users browse available job opportunities on **Udyog Saarthi**.

- Job listings appear as **dynamic cards** showing Job Title, Organization, Disability Category, and a brief description.
- Each card has a **“View Details”** or **“Apply”** button; clicking **Apply** saves the job under the user’s profile in **localStorage**.
- Users can filter jobs by **disability type** using a dropdown menu.
- The top navigation bar includes **Home**, **My Applications**, and **Logout** links for easy access.

- A **responsive grid layout**, clear typography, and high color contrast ensure the page is **accessible and user-friendly** on all devices.

My Applications Page:



The **My Applications Page** shows all jobs that a user has applied for on **Udyog Saarthi**.

- Each job is displayed as a **card** with Job Title, Organization, and **Application Status**.
- The status indicates whether the application is **active**, **under review**, or **removed by the admin**.
- If removed, the **Reason for Removal** is clearly shown to maintain transparency.
- Users can **withdraw active applications** or **refresh the list** to see updates.
- The page uses consistent spacing, clear labels, and easy navigation to ensure **accessibility** for all users, including those using assistive technologies.

Comparative Analysis with Existing Job Portals

Feature	Udyog Saarthi	Generic Portal (e.g., Naukri.com)	Government Portal (e.g., NCS)
Disability-specific Filtering	✅ Users can filter jobs by disability type	❌ Not available	⚠️ Limited checkbox filter only
Transparent Rejection Feedback	✅ Admins provide reasons for removal	❌ Not available	❌ Only generic status updates
Accessibility & UI Design	✅ Large fonts, high contrast, simple navigation for PwDs	❌ Complex interface, small text, no assistive features	⚠️ Moderate accessibility, text-heavy
PWA Support	✅ Installable, works like a mobile app	❌ Not supported	❌ Web-only, internet required
Offline Mode	✅ Core features accessible offline via cache/localStorage	❌ Not supported	❌ Fully online-dependent
Target Audience Focus	✅ Exclusively for PwDs under 4% reservation	❌ General population	⚠️ Limited disability-friendly features

Summary:
Udyog Saarthi provides a **disability-focused, accessible, and offline-capable PWA**, offering transparency and user-friendly navigation, unlike most generic or government job portals.

Chapter 7: Conclusion and Future Work

7.1 Conclusion

The Udyog Saarthi project successfully illustrates the design, development, and deployment

of a Progressive Web-based Job Portal specifically tailored for Persons with Disabilities (PwDs) in India. The primary objective of the system was not only to facilitate employment opportunities but also to ensure an inclusive, accessible, and transparent process. By leveraging modern web technologies alongside accessibility best practices, Udyog Saarthi effectively bridges the gap between job seekers with disabilities and potential employers, aligning with the guidelines of the Rights of Persons with Disabilities (RPwD) Act, 2016.

The system addresses two major challenges faced by PwDs in the employment sector — lack of awareness and limited accessibility. Many individuals eligible under the 4% reservation category remain unaware of existing job opportunities or struggle with the usability of conventional online job portals. Udyog Saarthi overcomes these barriers by providing a simple, mobile-friendly interface, intuitive navigation, and offline access through its Progressive Web App (PWA) design. This demonstrates how accessible technology can be harnessed as a tool for social inclusion, especially for historically marginalized communities.

Implementation covered all critical functionalities, including User Registration and Login, Job Posting and Management (Admin), Disability-specific Job Filtering, and Transparent Feedback for application removals. These modules allow users to register, apply for jobs, and monitor their application status seamlessly. Administrators can efficiently post job opportunities, manage applicants, and ensure transparency by providing clear reasons for rejection. The feedback mechanism fosters trust and clarity between users and the system, addressing a common shortfall in many existing portals.

Beyond technical achievement, Udyog Saarthi represents a socially impactful innovation, demonstrating how software engineering can serve humanitarian objectives. The project supports diversity, inclusion, and equal opportunity while aligning with key United Nations Sustainable Development Goals (SDGs):

- **SDG 4 – Quality Education**, by promoting awareness and learning opportunities,
- **SDG 8 – Decent Work and Economic Growth**, by enhancing employability for PwDs, and
- **SDG 9 – Industry, Innovation, and Infrastructure**, by delivering an inclusive digital platform.

Technically, the application highlights the advantages of PWA technology: platform independence, no requirement for app store installation, and functionality under limited internet connectivity. These benefits are particularly significant for users in rural and semi-urban regions. The project also demonstrates the potential of lightweight, client-side applications to address accessibility challenges efficiently without high infrastructure costs.

In conclusion, Udyog Saarthi validates that inclusive design and accessible software are essential components of modern digital solutions. The system achieves its goals of empowering PwDs, enhancing employability, and fostering digital inclusion, establishing itself as a meaningful contribution to both academic research and social impact initiatives.

7.2 Future Enhancements

Although the current Udyog Saarthi prototype successfully achieves its core functional objectives, there is significant potential to enhance the system for real-world deployment, scalability, and improved user experience. The following areas are proposed for future development:

1. **Backend Integration**

   Currently, the application relies on browser localStorage, which is suitable for prototyping but limits multi-user support and scalability. Future versions should incorporate a cloud-based backend using technologies such as Node.js, Express.js, and MongoDB or Firebase Firestore. This would enable centralized data management, persistent sessions, and synchronization across multiple devices. Advanced authentication mechanisms like JWT (JSON Web Tokens) or OAuth can also be implemented to strengthen data security and privacy for users and administrators.

2. **Advanced Accessibility Features**

   While the present version incorporates basic accessibility principles such as high-contrast design and simple layouts, the platform can be further enhanced with features like full screen reader compatibility, text-to-speech for job descriptions, voice-based navigation, and keyboard-only operation. These enhancements would ensure compliance with WCAG 2.1 guidelines and broaden accessibility for users with visual, motor, or cognitive impairments. Formal testing with assistive technologies such as NVDA and JAWS would further validate inclusivity.

3. **Notification and Alert System**

   Timely communication is critical in practical use. Push notifications can be implemented to inform users about new job postings relevant to their disability, updates to application status, or availability of training programs. Firebase Cloud Messaging (FCM) or Web Push API can enable real-time alerts, while additional channels like email and SMS can extend reach and accessibility.

4. **Employer Portal**

   Introducing a dedicated portal for employers will allow verified organizations to

register, post job openings, and manage applicants directly. Employers could filter candidates by disability type, skills, and qualifications, and view anonymized metrics to assess hiring diversity. This would create a two-way platform, facilitating direct interaction between PwDs and employers in both private and public sectors.

5. **Integration with Government Databases and APIs**
   Connecting with official government APIs from entities such as NIEPMD, the Ministry of Social Justice & Empowerment, and the National Career Service (NCS) would allow automatic synchronization of verified job listings, training programs, and reservation updates. Such integration would ensure reliable, up-to-date information and support national initiatives aimed at centralizing employment opportunities for PwDs.
6. **Skill Development and Learning Module**
   A dedicated Skill Development section could provide curated educational resources, online courses, and vocational training materials suitable for different disability categories. Linking with open educational resources and e-learning platforms would enable users to upskill and enhance employability. The module could also include guidance for parents and guardians, gradually evolving into a complete learning ecosystem within the platform.
7. **Analytics and Reporting Dashboard**
   An analytics dashboard for administrators would offer insights into user registrations, popular job categories, and applicant demographics. These analytics can support data-driven decision-making, help identify trends in PwD employment, and facilitate targeted training or intervention programs by institutions and policymakers.
8. **Multi-language Support**
   To address language barriers and improve digital literacy, multi-language support (e.g., English, Hindi, Kannada, Tamil) should be implemented. Localizing the user interface and job descriptions will increase inclusivity, particularly in rural and regional areas where English proficiency may be limited, thereby expanding the platform's reach and usability.

7.3 Summary

In conclusion, Udyog Saarthi, while currently functioning as a prototype, establishes a robust groundwork for a comprehensive, accessible employment platform at a national scale. The

system demonstrates the feasibility of a dedicated portal for Persons with Disabilities (PwDs), addressing both awareness and usability barriers. Future enhancements should prioritize scalability, advanced accessibility, and integration with backend systems and government databases to transition the platform from a conceptual prototype to a sustainable, real-world digital service.

By implementing the suggested improvements, Udyog Saarthi can grow into a complete ecosystem connecting PwDs, employers, and skill development providers within a unified digital framework. The project exemplifies how inclusive technology can actively promote equality, improve employability, and support social empowerment. With ongoing refinement, iterative user feedback, and community engagement, Udyog Saarthi has the potential to become a benchmark for inclusive employment platforms in India, serving as a model that can inspire similar initiatives globally.

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