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Migrant Care : A Web-based Support System for Migrant Workers

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Abstract

Migrant Care aims to enhance support for Migrant workers in Tamil Nadu by developing a web-based platform to address challenges such as language barriers, limited real-time assistance, and inefficient administrative oversight. The proposed method involves developing a centralized system using Next.js for frontend, Convex for real-time backend services, and Firebase for secure authentication, enabling worker registration, complaint submission with immediate email notifications, and immediate announcements The research has integrated the i18n to resolve the language barrier, it supports six languages, such as Tamil, English, Telugu, Hindi, Kannada, and Malayalam. Migrant Care was designed for low literacy people and it has a simple and secure interface. The user-friendly web platform enables the migrants to easily sign up with their Email Id. Every migrant can have their own dashboard secured with their 12-digit unique ID . It enables the migrant to register with basic details, such as name, work, workplace, and contact. This platform with the details of the migrant can be used to file their complaints to the corresponding authority. The complaints reach the authority in form of high priority email alerts. The necessary announcements are updated by the administrator to keep every member in the platform informed about the important updates. Migrant Care has the special Admin Dashboard to monitor all the migrant data, complaints, and updating the announcements. Thus, the web platform was built to tackle the real struggles of the migrant workers.

Keywords: Migrant Care, Next.js, Convex, Firebase, Administrator, Announcement

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1. Introduction

1.1 Overview

In recent years, a huge number of migrant workers from various other states of India have moved to Tamil Nadu for occupation.. However, they face barriers, including linguistic diversity, low digital literacy, and continuous inadequate access to support systems[1-3]. Traditional methods like manual records and helplines are slow and fail to meet the needs of a mobile, multilingual workforce. Migrant Care, a web-based platform, utilizes modern technology to overcome these obstacles, enabling a centralized hub for registration, complaint reporting, and real-time communication. Its significance lies in empowering a marginalized workforce in Tamil Nadu, by providing a way to enhance their welfare and connectivity[4-8]. The relevance of this method stems from its alignment with the growing need for an inclusive, technology-driven solution in labor support, particularly in a region with diverse migrant inflows [9-13].

1.2 Contributions and Limitations Addressed

The proposed method is significant as it bridges the gap between migrant workers and support services, a pressing issue in Tamil Nadu where existing systems lack efficiency and reach. Its relevance is emphasized by its focus on real-time, multilingual support, addressing the immediate needs of a workforce often overlooked by static government portals.

- A streamlined registration system assigns unique IDs for efficient tracking.
- Instant complaint notification to administrators, improving response times.
- Real-time announcements, enhancing accessibility and safety.
- An admin dashboard for comprehensive oversight, optimizing resource allocation.

2. Existing Websites

Technology-based support for migrant workers includes government portals and NGO-led apps. The following supports real-time data but isn't customized for migrant welfare. These systems highlight gaps in accessibility, responsiveness, and inclusivity, which Migrant Care addresses through its integrated, worker-centric design. Some of the existing government portal are as follows.

- **e-Shram Portal** (https://eshram.gov.in/)

India's national database for unorganized workers, launched in 2021, aims to register millions with Aadhaar. Its interface confuses workers struggling to navigate, and digital literacy blocks many out. Migrant Care counters with user-friendly design, live updates.

- **Kudumbashree** (https://www.kudumbashree.org/)

Kerala's women-led initiative links workers to local help but falters outside its borders, skips real-time alerts, and misses quick complaint channels. Migrant Care stretches across Tamil Nadu, delivers instant updates, and lets workers report issues in a snap.

- **Sahana** (https://www.sahanafoundation.in/)

An open-Source disaster tool with real-time data, but it's not built for worker welfare with no sign-ups, no grievance system. Migrant Care takes that real-time edge and crafts a full support net, from registration to live admin oversight.

3. Proposed Work

Migrant Care is a web-based platform designed to provide a centralized, secure, and efficient solution for registering, tracking, and supporting migrant workers in Tamil Nadu. operational framework and development methodologies of the proposed system is stated below.

3.1 Tools, Libraries, and APIs

The Migrant Care platform utilizes a modern technology stack to deliver its functionalities. The frontend is built using Next.js, a React framework known for its performance and user experience. Convex serves as the real-time backend, ensuring seamless data synchronization and efficient operations. Secure user authentication is handled by Firebase. For deployment and hosting, the platform utilizes Vercel. To facilitate immediate communication regarding complaints, Nodemailer is integrated for email services. Key libraries employed include React for building the user interface, the Convex Client for real-time backend interaction, the Firebase Authentication SDK for managing logins, i18n for supporting multiple languages, and Nodemailer for sending emails. The platform interacts with several APIs, including the Convex API for data management and backend functions, the

Firebase Authentication API for secure user authentication through OAuth, and the Nodemailer API for sending out timely notifications.

3.2 Technical Details

- **Next.js:** Next.js serves as the frontend framework for Migrant Care, a React-based framework chosen for its speed and simplicity in powering the user interface. It employs server-side rendering (SSR) to improve initial load times. The platform utilizes file-based routing, where dashboard is dedicated to worker registration and reporting, and admin provides an oversight interface for administrators, with each route mapping to corresponding React components. Next.js connects to Convex through API routes to store data and trigger actions using asynchronous fetch calls. The selection of Next.js was driven by its fast SSR, which significantly reduces load times for users on slower mobile devices, its flexible and straightforward routing system, and its scalability, allowing Vercel to handle a large user base without data integrity issues. Ultimately, Next.js contributes to a smooth and welcoming user experience for Migrant Care.

- **Firebase:** Firebase provides the security for the system , using Google's robust tools to handle authentication effectively. Specifically, the method utilizes Firebase Authentication with Google OAuth 2.0, allowing workers to sign in securely using their Google accounts. When a worker clicks “Continue with Google” on the Next.js frontend, Firebase initiates a login window, verifies their credentials, and upon successful authentication, sends this information to Convex, linking it to the worker's unique 12-digit ID for tracking. The entire process is secured with HTTPS and token encryption. Firebase's SDK seamlessly manages the OAuth flow and redirects the authenticated user to their dashboard.

- **Convex:** Convex is the backend of Migrant Care, It is a real-time database and serverless platform that keeps everything stored all time. It’s built to sync data live across all users, with no delays. the proposed user interface has three tables: workers (contains name, contact, work, workplace, location, unique id), complaints (contains workerId, description, createdAt), and announcements (contains title, content, createdAt). It also runs serverless functions like sending Nodemailer emails for

complaints. We picked Convex because it's fast and scalable, ready for 1.2 million workers without breaking the infrastructure.

- **I18n:** i18n, short for "internationalization," is the tool implemented to overcome language barriers, supporting six languages: English, Tamil, Telugu, Kannada, Hindi, and Malayalam. When a worker selects "Tamil" from a dropdown menu, Next.js i18n routing dynamically loads the appropriate translations, and React updates every label accordingly. This functionality is integrated into the frontend through a useTranslation hook. i18n was chosen for its lightweight nature, speed, and ability to provide a familiar user experience, regardless of the worker's origin

- **Nodemailer:** Nodemailer functions as the messaging component, a Node.js module is used for direct email transmission from Migrant Care to administrators. Operating within Convex's serverless functions, it connects to Gmail's SMTP server (smtp.gmail.com, port 587). When a worker submits a complaint, Convex retrieves the details, and Nodemailer generates an email with the subject "New Complaint" and a body containing the "Worker ID" and "Issue," addressed to the designated authority's Email ID. This process ensures rapid notification using secure TLS encryption through Gmail's authentication. Nodemailer was selected for its lightweight nature, eliminating the necessity for a full email server, its reliability with high delivery rates, and its seamless integration with Convex. This integration guarantees swift alerts to administrators, minimizing wait times for workers

3.3 System Architecture

Migrant Care features a secure client-server architecture (Figure 1) . The frontend, built with Next.js, manages user interactions through designated pages. Employing server-side rendering, Next.js ensures swift page delivery, even on networks with limited bandwidth. Communication between the Next.js frontend and the Convex backend occurs through API routes, utilizing the Convex Client library over HTTPS for secure data transfer. Convex is responsible for managing data tables, providing real-time data synchronization through websockets, and executing serverless functions, including the dispatch of email notifications through Nodemailer. User authentication is securely handled by Firebase Authentication, which implements Google OAuth logins and issues secure tokens for verification with Convex.

- Frontend: Next.js handles user interactions with server-side rendering for performance.
- Backend: Convex manages a real-time database and serverless functions.
- Authentication: Firebase verifies users through Google login, passing tokens to Convex.

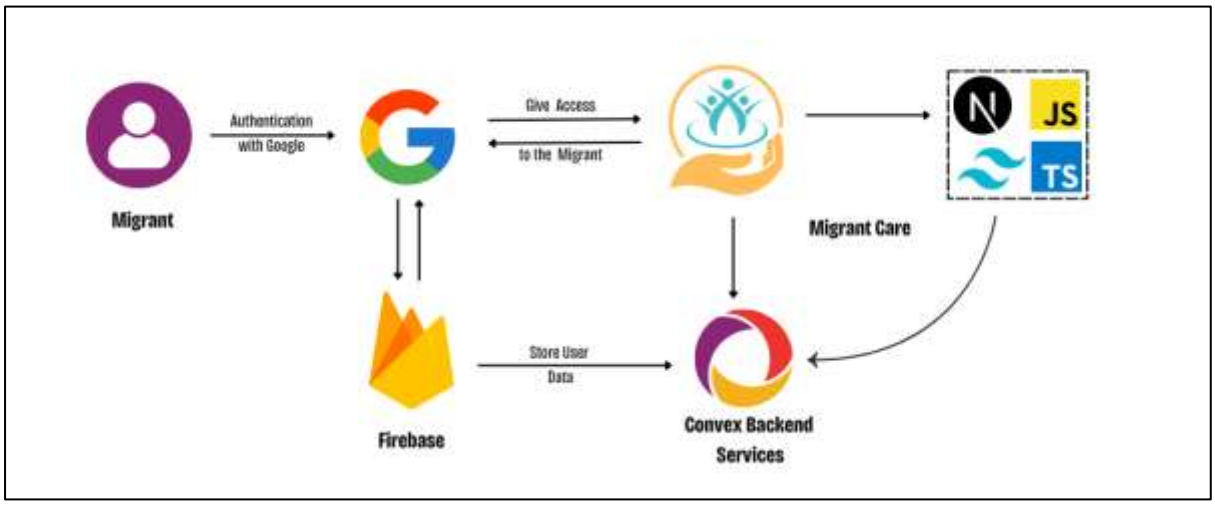

Figure 1. High-Level Architecture Diagram

3.4 Use Case in Migrant Care

The use case defines the actions available to users in Migrant Care. It includes two roles: Migrant and Admin. Migrants have three actions: Sign In (Google OAuth through Firebase), Register, and Submit Complaints. Convex stores it. Admins have four actions: Maintain the Sign In, View Worker Data, Post Announcements, and Manage Complaints. Convex enables real-time updates between roles. Access is role-based: Migrants use public routes, Admin use restricted routes. The following Figure 2 describes the Use Case of Migrant Care, and the use case includes:

- Migrant
- Admin

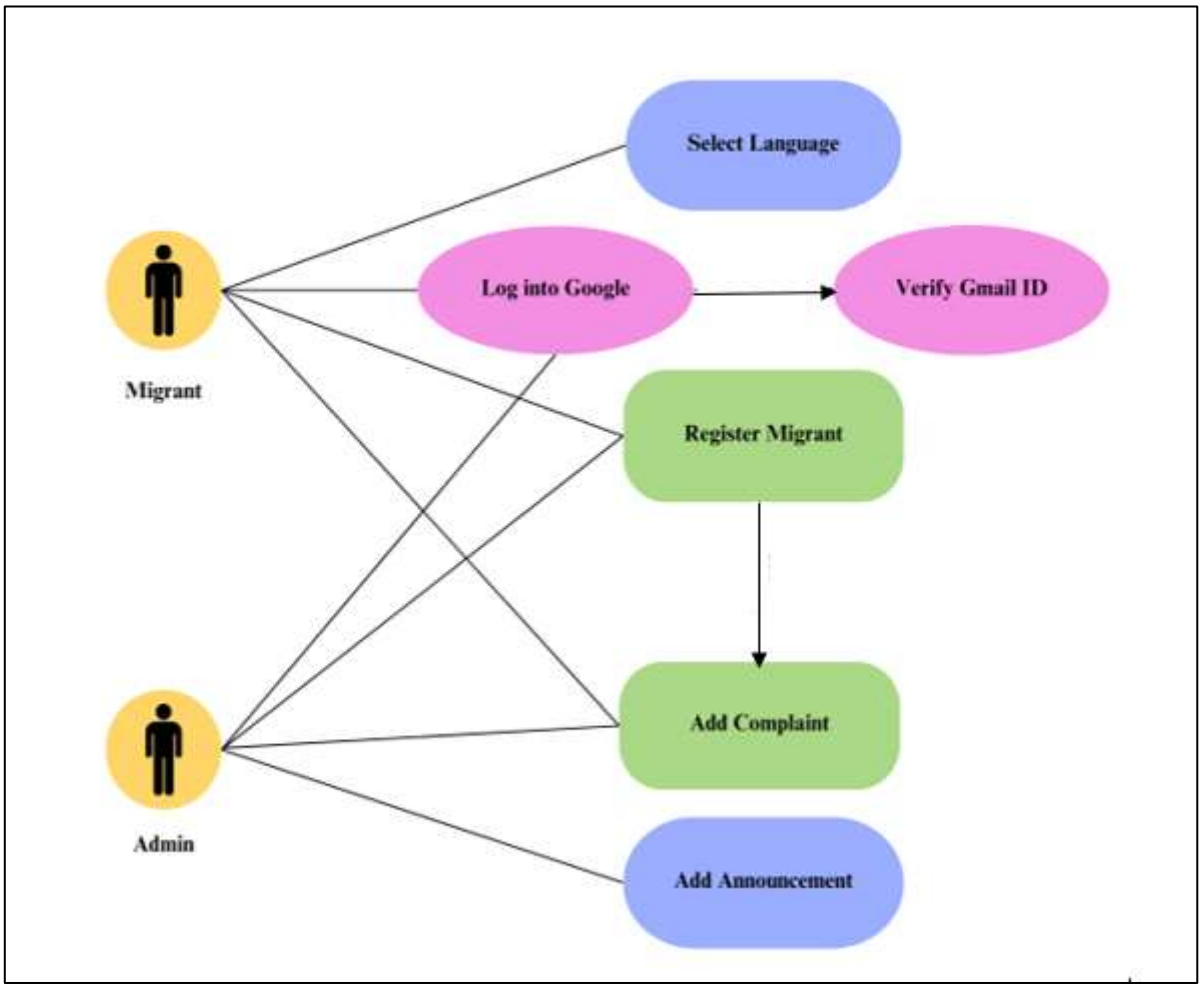

Figure 2. Use Case Diagram of Migrant Care

3.4 Workflow in Migrant Care

The process initiates with a secure Migrant Sign-In, followed by a straightforward Registration step where essential user data is securely stored within the Convex backend. Subsequently, the workflow branches into two primary paths. The first involves the migrant's ability to Submit a Complaint, which is immediately recorded within Convex. This recorded complaint is then readily accessible to the Administrator, who is responsible for reviewing and managing all submitted complaints. This structured workflow is intentionally implemented to ensure a rapid and transparent interaction between migrant workers and administrative personnel, ultimately facilitating swift responses and timely updates regarding their concerns.

The Figure 3 describes the Workflow of Migrant Care. the workflow includes:

- Sign-In
- Registration

- Complaints
- Announcements
- Admi Oversight.

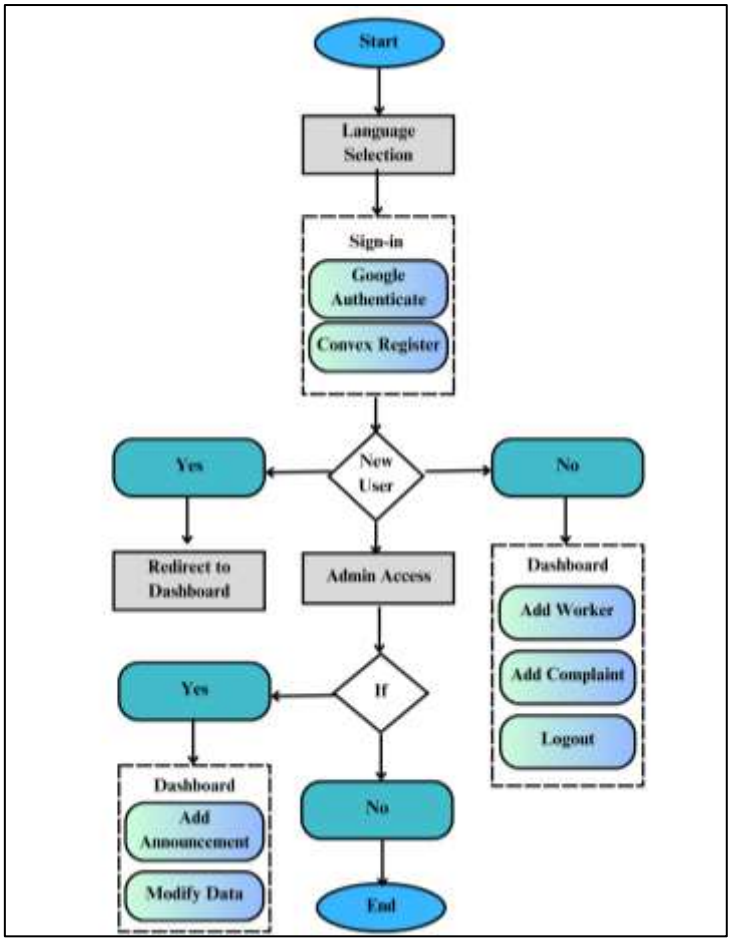

Figure 3. Workflow of User Authentication and Dashboard Access Process for a System.

4. Results and Discussion

4.1 Result

The platform demonstrated satisfactory performance across both desktop and mobile environments. Performance testing was carried out using the Chrome DevTools performance tab, with measurements averaged and outliers removed to ensure the accuracy of the results. Comprehensive testing procedures were applied to assess Migrant Care's responsiveness and efficiency on both desktop and mobile devices. The time taken to process are as follows.

- Registration average time was 300ms.
- Complaint Submission average time was 450ms.
- Announcements were synced to frontend in 250ms.
- Language Translations were switched between the six languages in under 100ms.

Functionality was consistent across devices, with no failures in registration, complaint logging, and announcement display. The system supported simultaneous access by various without performance degradation, indicating initial scalability.

4.2 Discussion

Measured times for registration and complaint submission indicate a significant efficiency gain compared to traditional methods such as manual record-keeping and even the e-Shram portal. The e-Shram portal reportedly lacks real-time features and experiences delays ranging from seconds to minutes due to server load, increasing the risk of lost issues. In contrast, Migrant Care's performance surpasses digital alternatives like Kudumbashree, which notably lacks an integrated complaint system. Migrant Care's real-time data synchronization, facilitated by Convex, provides a distinct advantage over e-Shram's static database architecture. Furthermore, the platform's integrated support for six languages through i18n directly addresses a essential gap in existing monolingual systems, significantly enhancing accessibility for Tamil Nadu's diverse migrant population. The scalability of Migrant Care also appears promising, with Vercel hosting suggesting a robust capacity to handle a substantial user base smoothly, with potential for further optimization to enhance capacity.

4.3 Output Screenshots

The Output Screenshots of Migrant Care are captured from the deployed system during testing is illustrated in Figure 4 through 8.

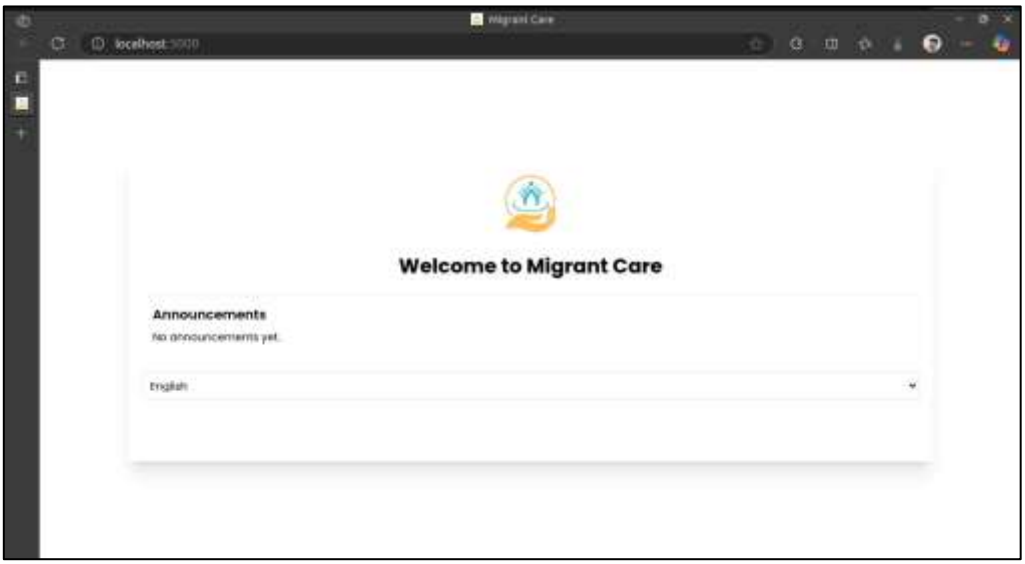

Figure 4. Migrant Care Homepage

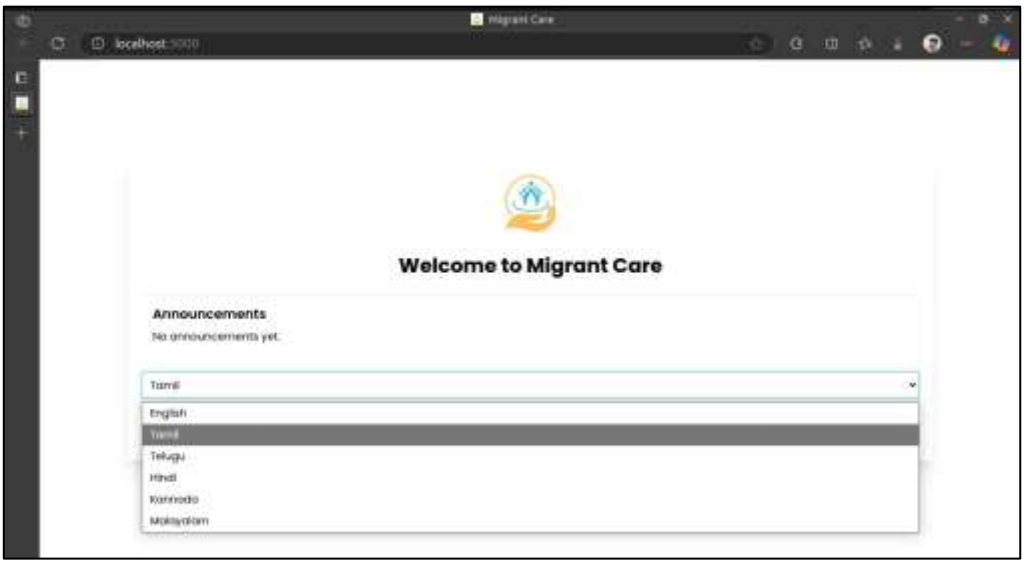

Figure 5. Displays Language Selection Before Sign-In

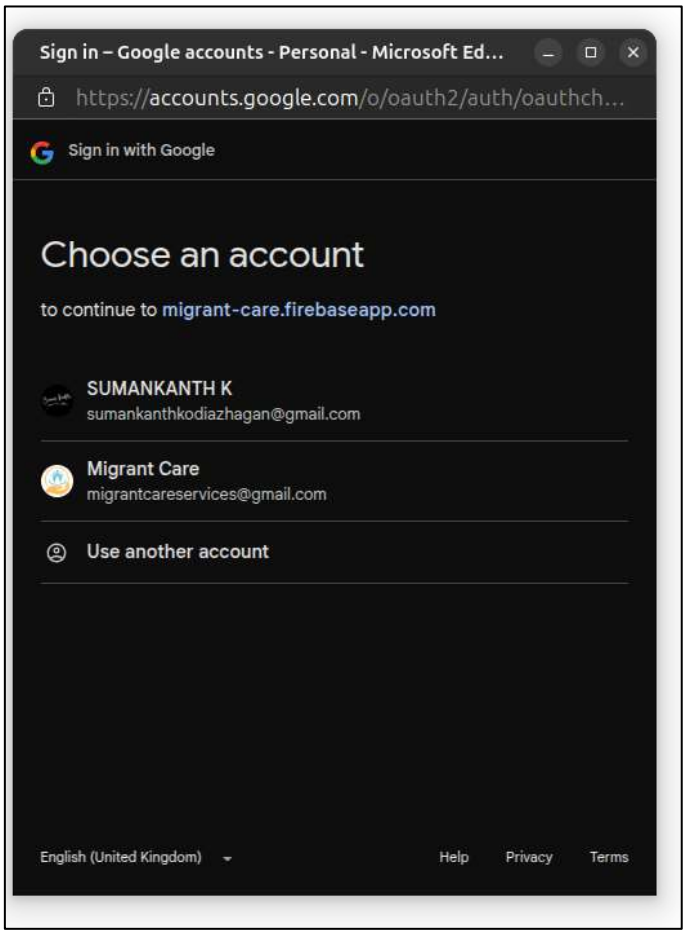

Figure 6. Sign in Options

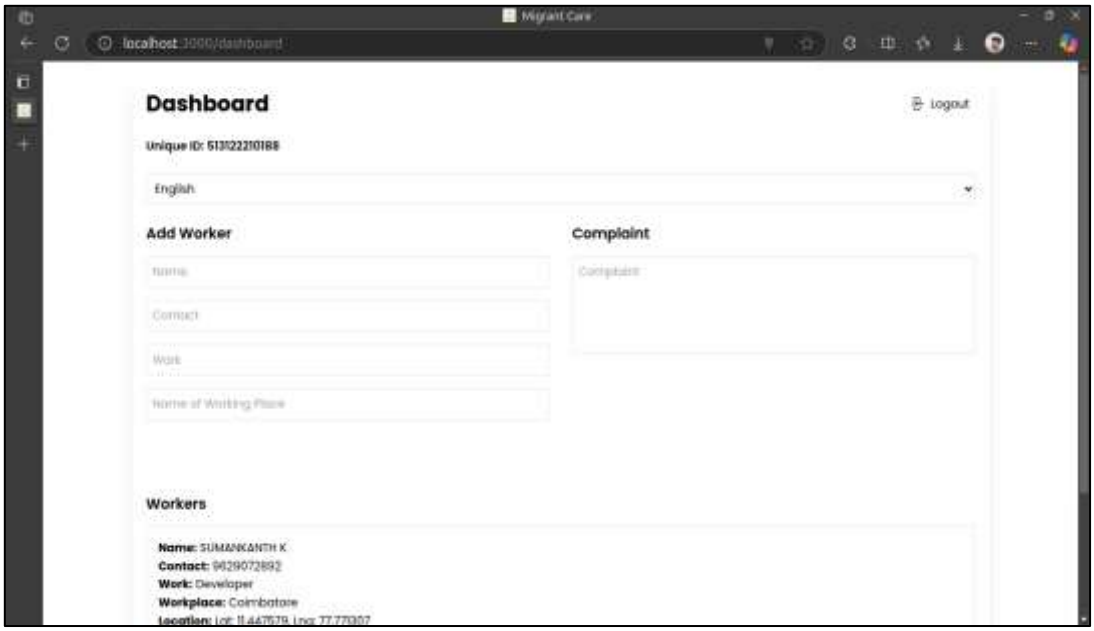

Figure 7. Dashboard with Unique ID and Sections for Adding Worker Details and Complaints.

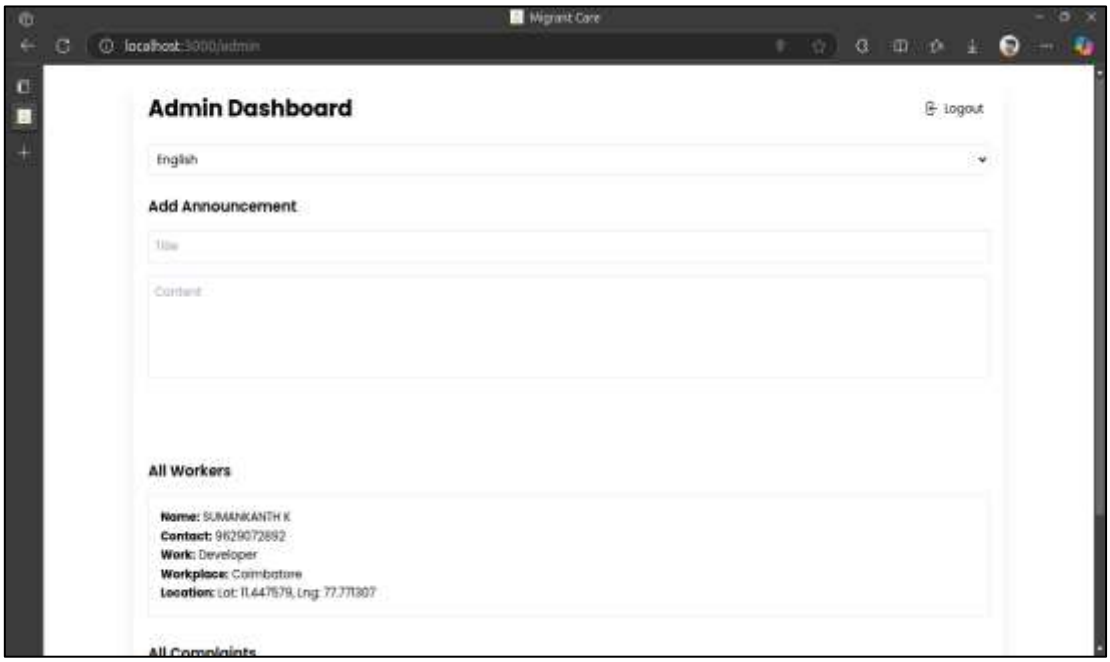

Figure 8. Admin Dashboard with Worker Details, Complaints, and Announcement

5. Conclusion

Migrant Care is a web-based platform developed to support Tamil Nadu's 1-2 million migrant workers by addressing linguistic barriers, slow support, and tracking issues. It integrates Next.js for fast frontend, Convex for real-time data management, Firebase for secure authentication, Nodemailer for instant complaint notification, and i18n for multilingual support. Testing confirmed its effectiveness, it scales to handle large user bases, delivering quick access, reliable grievance reporting, and live updates in multiple languages like English, Tamil, Telugu, Kannada, Hindi, and Malayalam. This outperforms manual systems and digital alternatives by reducing delays and enhancing accessibility, directly improving workers' welfare and administrative efficiency in Tamil Nadu. Future enhancements include integrating speech-to-text for voice input to illiterate workers with verbal registration and report complaints easily, implementing Next.js service workers and Convex caching for offline mode to store data locally in the browser with sync on reconnect, adding real-time chat support through Convex for immediate help in critical situations, and incorporating an SOS button for rapid emergency responses to life-threatening situation, further enhancing workers safety and trust in the platform.

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