

FULL STACK JOB RECOMMENDATION SERVICE USING MACHINE LEARNING

A

Project Report

submitted for the partial fulfilment

of B.Tech. Degree

in

INFORMATIONAL TECHNOLOGY

by

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Contents

DECLARATION.....	i
CERTIFICATE.....	ii
ACKNOWLEDGEMENT.....	iii
ABSTRACT.....	iv
LIST OF FIGURES.....	v
LIST OF TABLES.....	vi
1. INTRODUCTION	
2. LITERATURE REVIEW	
3. METHODOLOGY	
3.1 MOTIVATION	
3.2 ACTION PLAN	
3.2.1 TIMELINE OF COMPLETION (GANTT CHART)	
3.2.2 SOFTWARE DEVELOPMENT LIFE-CYCLE	
3.3 PROPOSED MODEL	
3.3.1 CLASS DIAGRAM OF ROZGAAR APP	
3.3.2 STEP-BY-STEP WORKFLOW OF ROZGAAR APP	
3.4 DESIGN	
3.4.1 HIGH-LEVEL DESIGN	
3.4.2 LOW-LEVEL DESIGN	
3.5 IMPLEMENTATION	
3.5.1 TECH STACK	
3.5.2 API, ROUTES, ENDPOINTS	
3.5.3 IMAGES OF PAGES RENDERED	
3.5.4 KNN ALGORITHM	
3.6 TESTING AND DEPLOYMENT	
4. EXPERIMENTAL RESULTS	
5. CONCLUSIONS	
REFERENCES	
ANNEXURE	

Declaration

We hereby declare that this submission is our own work and that, to the best of our belief and knowledge, it contains no material previously published or written by another person or material which to a substantial error has been accepted for the award of any degree or diploma of university or other institute of higher learning, except where the acknowledgement has been made in the text. The project has not been submitted by us at any other institute for requirement of any other degree.

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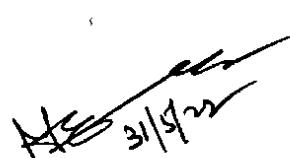
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Certificate

This is to certify that the project report entitled "Full Stack Job Recommendation Service using Machine Learning" presented by Anshika Yadav, Sandeep Yadav and Utkarsh Goel in the partial fulfilment for the award of Bachelor of Technology in Computer Science and Engineering, is a record of work carried out by them under my supervision and guidance at the Department of Computer Science and Engineering at Institute of Engineering and Technology, Lucknow.

It is also certified that this project has not been submitted at any other Institute for the award of any other degrees to the best of my knowledge.



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Acknowledgement

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Date: 31-05-2022

In the accomplishment of completion of our project "Full Stack Job Recommendation Service using Machine Learning", we would like to convey our special gratitude to Prof. Manish Gaur, Ms. Priyanka Gautam and as well as entire faculty of Department of Computer Science and Engineering at Institute of Engineering and Technology, Lucknow.

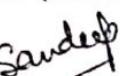
Their valuable guidance and suggestions helped us in various phases of the completion of this project. We will always be thankful to them in this regard.

We are ensuring that this project was finished by us and not copied.

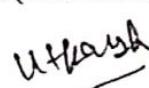
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Abstract

A platform (web-application) tailored for daily-wage workers (like painters, gardeners, etc.) and their recruiters to connect in order to increase their employability during a global pandemic crisis.

We used Machine Learning algorithms like K-Nearest Neighbors etc. to perform optimal job recommendation based on their location, search history and personal preferences.

Features included are: Google authorization login system for both workers and recruiters, job posting service for recruiters who can contact a worker to hire him/her directly as well, choice-based dashboard to display jobs and profiles with dynamic data update, and filter options according to preferences etc.

List of Figures

Figure 3.2.1 Timeline of Completion (Gantt Chart).....	x
Figure 3.2.2 Software Development Life-cycle.....	x
Figure 3.3.1 Class Diagram of RozGAAR App.....	xi
Figure 3.3.2 Step-by-Step Workflow of RozGAAR App.....	xii
Figure 3.5.3 (1) Home Page.....	xv
(2) Steps to create new job.....	xvi
(3) Job Postings Dashboard.....	xvii
(4) Jobs created by User.....	xvii
(5) Profile Page.....	xviii
(6) Update Profile.....	xviii
(7) About Us Page.....	xix
(8) Contact Us via E-mail.....	xix
(9) Filter Panel.....	xx
(10) Login Page.....	xxi
(11) Logout.....	xxi
(12) Sign-up Page.....	xxii
Figure 4.1 Worker Profiles.....	xxiv
Figure 4.2 Job Postings.....	xxvi

List of Tables

Table 3.5.2 APIs, Routes and Endpoints.....	xiv
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Chapter 1

Introduction

There has been a high immigration rate since the global pandemic. This led to many of the daily wage workers losing their jobs. Now, this increases unemployability and gives a fair strong problem statement to use the growing era of technology in favour of these daily wage workers to get more and easily accessible employment.

Objectives were to provide easy access to a certain app or tool that can be used by major two section of society concerned with our problem statement, namely:

1. The daily wage workers
2. The recruiters/general public who seek to employ these workers

We have given them a single platform to connect and manage their needs. Whether it is getting a job or getting the job done. It has Machine Learning algorithms in place to suggest and recommend jobs/workers to the respected section according to their needs. (Ref-4)

Chapter 2

Literature Review

As part of the literature review, here is an overview of various related works in this field that we have built our project in:

Indeed ^(Ref-1) is a US-based global job creation website launched in November 2004. It is part of Japan's Recruit Co. Ltd. and its headquarters are located in Austin, Texas and Stamford, Connecticut with additional offices worldwide. As a search engine with a single title, and is an example of direct search. It is now available in over 60 countries and 28 languages. In October 2010, Indeed.com surpassed Monster.com to become the most populous activity website in the United States.

LinkedIn ^(Ref-2) is an online service that focuses on American business and web-based applications and mobile applications. Launched on May 5, 2003, [4] this forum is mainly used for professional communication and career development, and allows job seekers to submit their CVs and employers to submit jobs. Since 2015, most of the company's revenue has come from sales to access information about its members to employers and marketing professionals. As of December 2016, it has been Microsoft's wholly owned subsidiary. As of September 2021, LinkedIn has 774+ registered members from more than 200 countries and territories.

Monster.com ^(Ref-3) is a global employment website owned and operated by Monster Worldwide, Inc. It was founded in 1999 with the merger of The Monster Board (TMB) and the Online Career Centre (OCC). It is a subsidiary of Randstad Holding, a Dutch international consulting firm, headquartered in Weston, Massachusetts. It is known for its Super Bowl XXXIII commercial "When I Grow Up", which features kids talking about their future career.

Naukri.com ^(Ref-7) is an Indian employment website operating in India and the Middle East. Naukri.com was founded in March 1997 by Indian businessman Sanjeev Bikhchandani, who started Info Edge (India) Ltd. in 1995. As of December 2016, Naukri.com had a database of about 49.5 million registered job seekers and an average of about 15,000 resumes were added daily while about 130,000 resumes were modified daily during the Fiscal year 2013–14. During the Fiscal year 2013–14, 51,000 corporate customers (including hiring consultants/firms) paid Naukri.com for services like database access, job postings, and advertising/listing on the site amongst others.

Daily Wage Worker ^(Ref-8) Platform provides information about 200+ initiatives across India to support 450 million migrants and daily wage workers during the pandemic. We partner with NGOs, Governments, Corporates, and Donors to provide food security, healthcare, and livelihoods to tackle the COVID-19 crisis. We are working with these partners to develop and support innovative pilot projects including the Dharavi ration kit, Swaasthya emergency health package, Rozgaar socio-economic survey, Vaccine hesitancy, and project Adhikar to provide access to government schemes, jobs, skills, and legal aid.

Chapter 3

Methodology

3.1 Motivation

There has been a high influx of immigrants since the global epidemic.

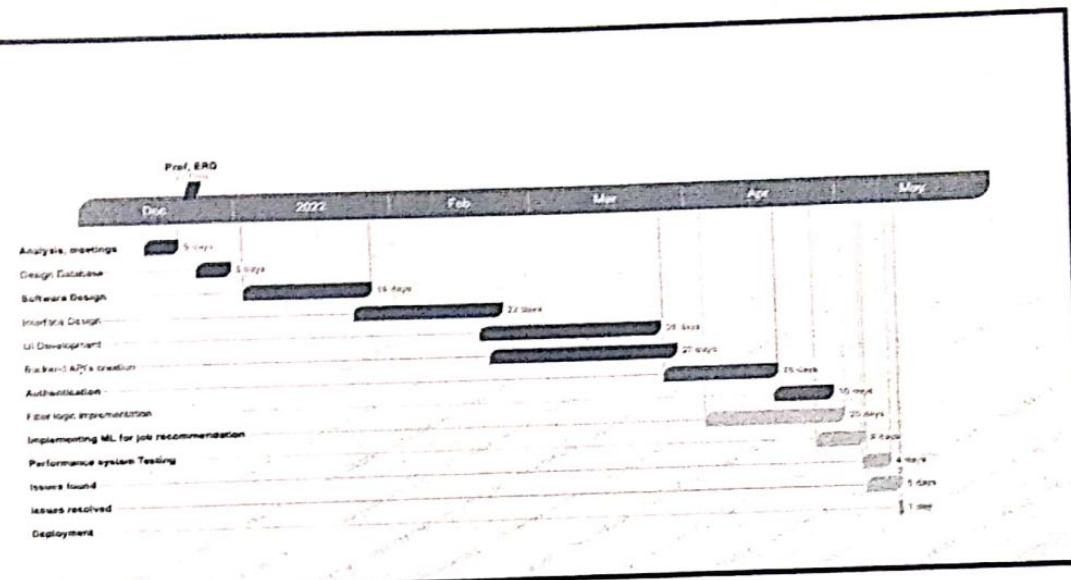
Because of a range of vulnerabilities such as high incidence of poverty, overcrowded housing conditions, and a strong focus on jobs where physical mobility is difficult, immigrants are at a much higher risk of COVID-19 infection than the native. Studies in several OECD countries have found that the risk of infection is at least twice that of native births.

COVID-related mortality rates for immigrants can also be significant, surpassing indigenous peoples.

Immigrants are at high risk in the labour market because of their often-unstable employment conditions and low job prospects. Research also suggests that discrimination is rampant in times of labour market instability, while contact networks - immigrants with a small income - are crucial to finding employment. (Ref-5 & Ref-6)

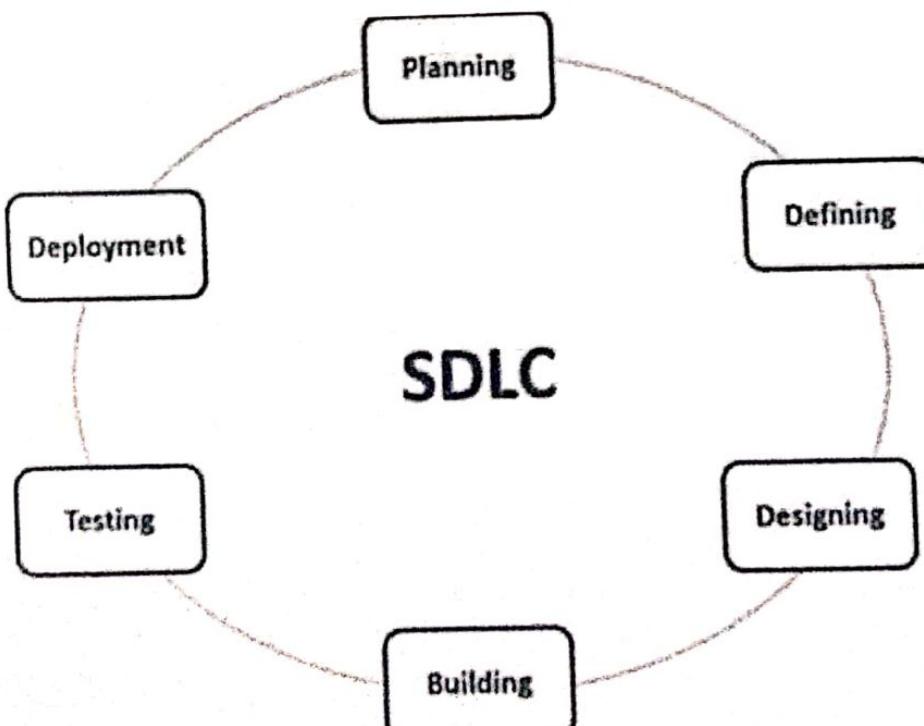
3.2 Action Plan

3.2.1 Timeline of Completion (Gantt Chart)



3.2.2 Software Development Life-cycle

We followed SDLC life-cycle to bring our project to completion.



3.3 Proposed Model

RozGAAR is a popular forum for day-to-day workers (such as painters, gardeners, etc.) and their employers to contact them to increase their employment during the global epidemic.

It has a simple one-click login where daily paid employees do not have to remember their username or password. Be a worker or a hiring person, we got it.

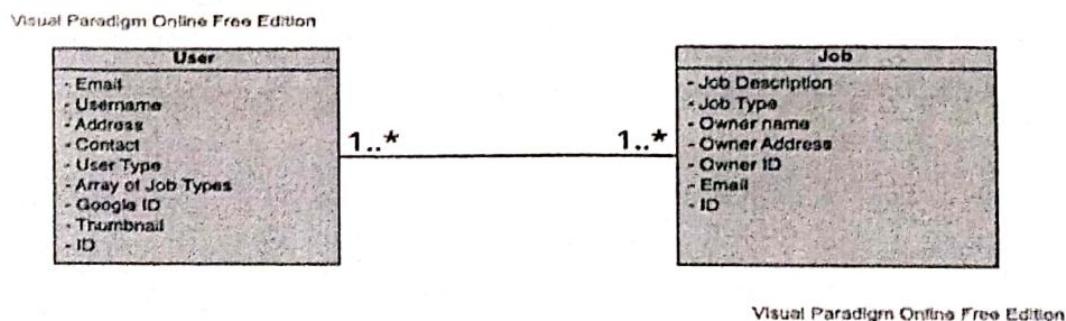
As a Worker, You Can

- Create your profile with your job selection.
- Get the full job you need in the job posted by our registered employers.
- Sort your activities according to your preferences and consult with your landlord.

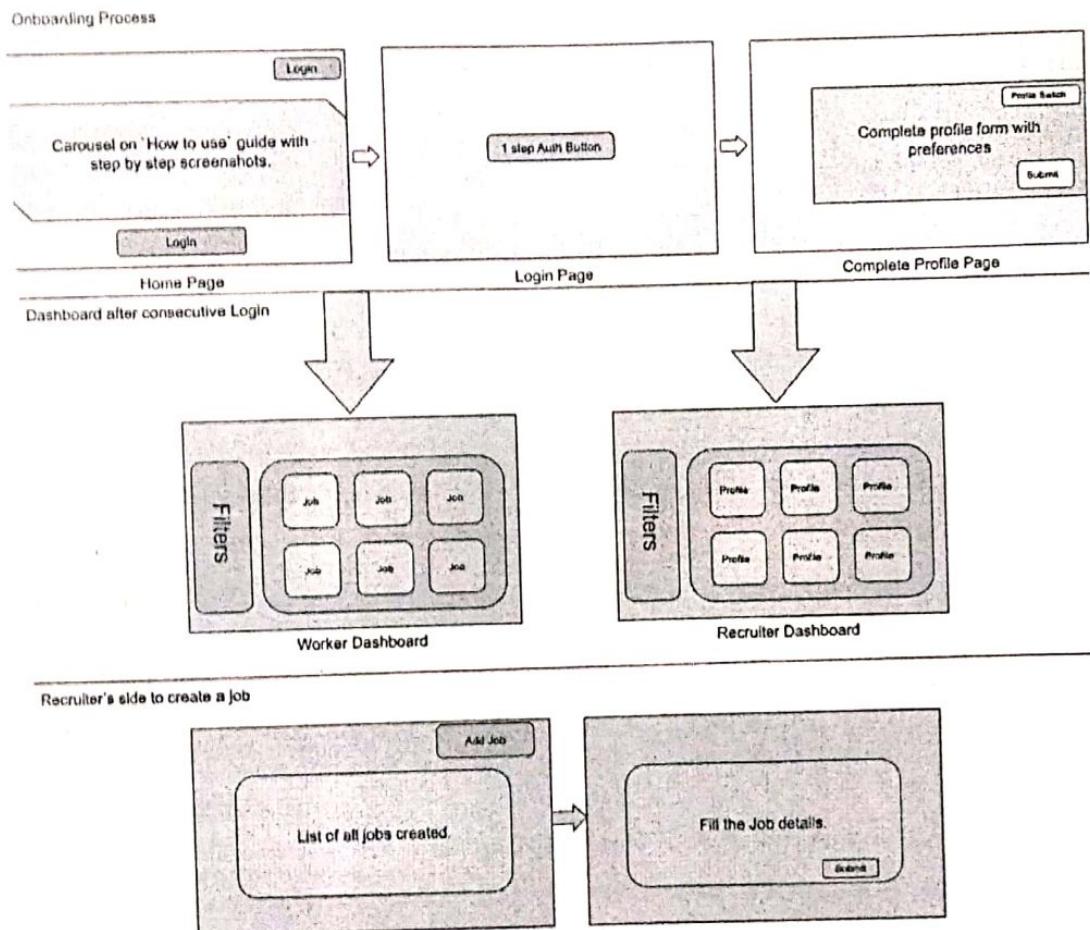
As an Employer, You Can

- Find the employee you need in your dashboard.
- Create job vacancies where an employee can contact you.
- Filter employee profiles according to your needs.

3.3.1 Class Diagram of RozGAAR App



3.3.2 Step-by-Step Workflow of RozGAAR App



3.4 Design

We divided our proposed model into subtasks and focussed on designing each of them separately as listed below.

3.4.1 High-Level Design

1. Routing
2. Filter Logic
3. Recommendation system

3.4.2 Low-Level Design

Back-End:

1. Schema design
2. API design
3. Filter logic design
4. Recommendation system design

Front-End:

1. UI/UX design
2. Routing
3. Server-side rendering management

3.5 Implementation

3.5.1 Tech Stack

1. NPM: Default package manager for the JavaScript runtime environment - Node.js
2. Node.js: Open-source, cross-platform, back-end JavaScript runtime environment that runs on the V8 engine and executes JavaScript code outside a web browser.
3. Express.js: Back-end web application framework for Node.js
4. MongoDB: Source-available cross-platform document-oriented NoSQL database program
5. EJS: Templating language that lets you generate HTML markup with plain JavaScript
6. HTML/CSS: Style sheet language used for describing the presentation of a document written in a markup language such as HTML
7. Scikit-learn: Software machine learning library for Python

3.5.2 APIs, Routes and Endpoints

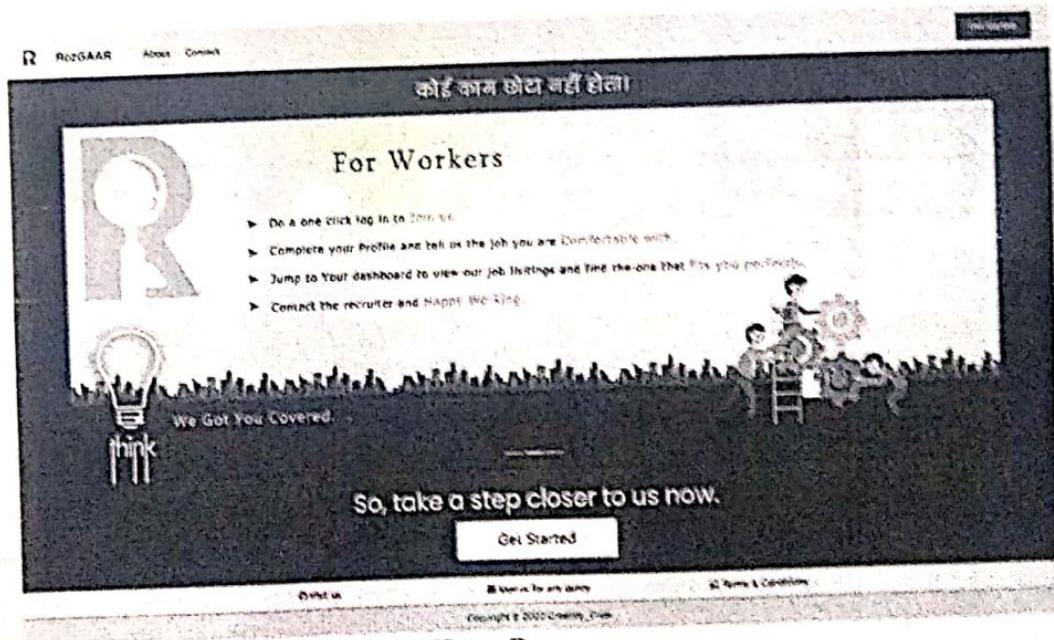
API Endpoint	Method	Use
/users/newjobs	GET	Get the new job creation form
/users/dashboard	GET	Get the dashboard
/users/jobs	GET	Get all jobs created by a user
/users/profile	GET	Get user profile page
/users/profile/update	GET	Get update profile page
/about-us	GET	Get about us page
/users/dashboard/filter	POST	Filter the data in dashboard
/user-recruiter	POST	Change data for user as recruiter
/user-worker	POST	Change data for user as worker
/users/newjobs/jobs	POST	Post a new Job for a user
/job/delete	POST	Delete a given job for a user

/jobs	POST	Get all the posted jobs
/google	POST	Redirect user to google for authentication
/auth/google/redirect	POST	Handle the redirection given by google to back to our website
/auth/login	POST	Initiate login process
/auth/signup	POST	Initiate signup process
/auth/logout	POST	Log user out
/	GET	To render home page
/users	POST	To create a new user
/contact-us	GET	To render contact us page

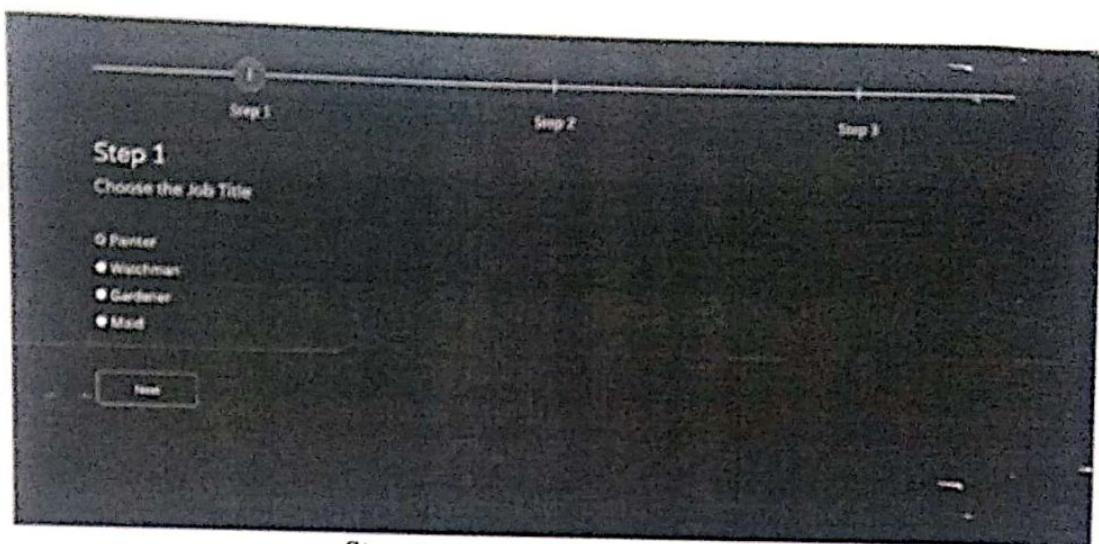
3.5.3 Images of pages rendered

GET APIs:

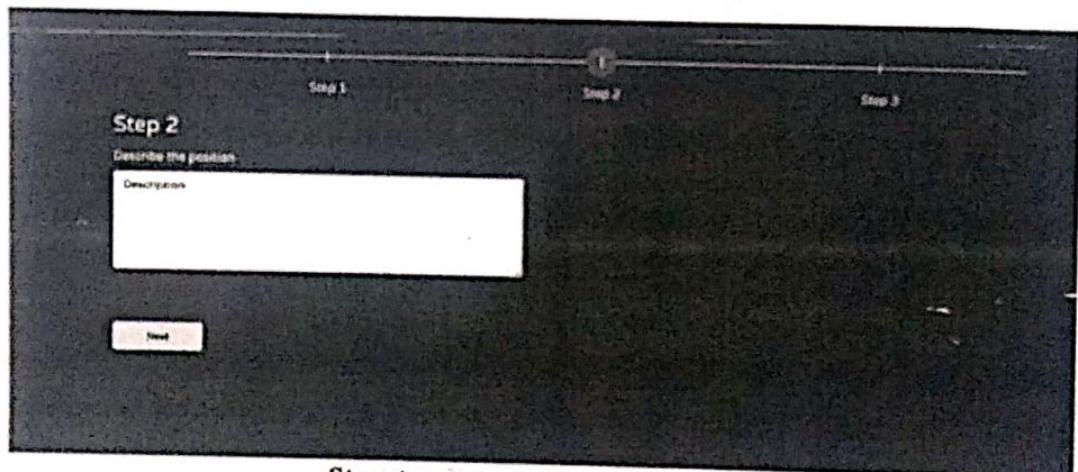
1. /: to render home page



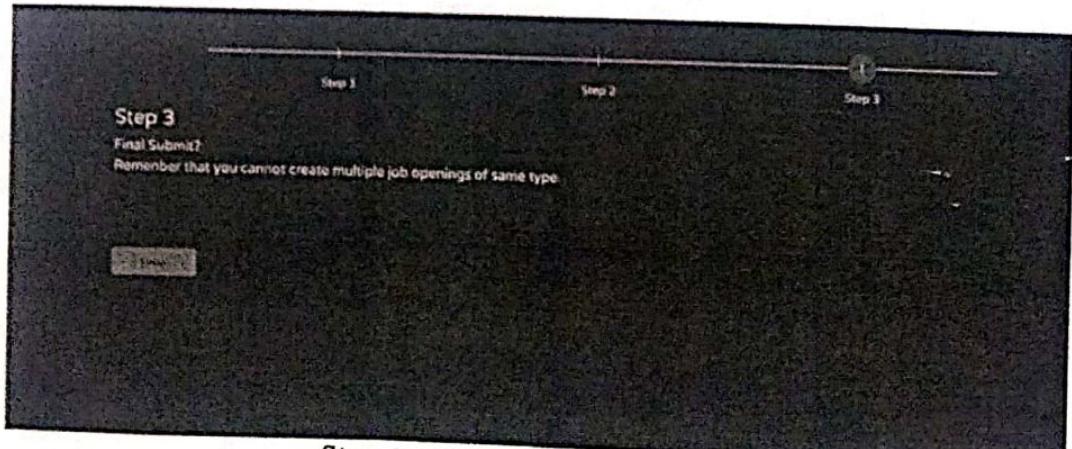
2. /users/newjobs: to render new jobs form



Steps to create new job (i)



Steps to create new job (ii)



Steps to create new job (iii)

3. /users/dashboard: to render dashboard

The screenshot shows a dark-themed dashboard titled "Available Job Postings". On the left, there's a user profile for "Sandeep" with a placeholder profile picture. Below it is a "Filter Jobs" section with checkboxes for "GARDENERS", "WATCHMEN", "PAINTERS", and "MAIDS", followed by a "FILTER" button. To the right, there are four job posting cards:

- Gardener**: Urgent need of a gardener! Address: Gorakhpur
- Gardener**: Two week gardening Address: Lucknow
- Gardener**: Experienced gardener needed Address: Varanasi

At the bottom of the dashboard, there are links for "View us", "Mail us for any query", and "Terms & Conditions". The footer includes the copyright notice "Copyright 12/2023 Creative_Crew" and navigation links for "RozGAAR", "About", "Contact", "Dashboard", "Profile", and "Logout".

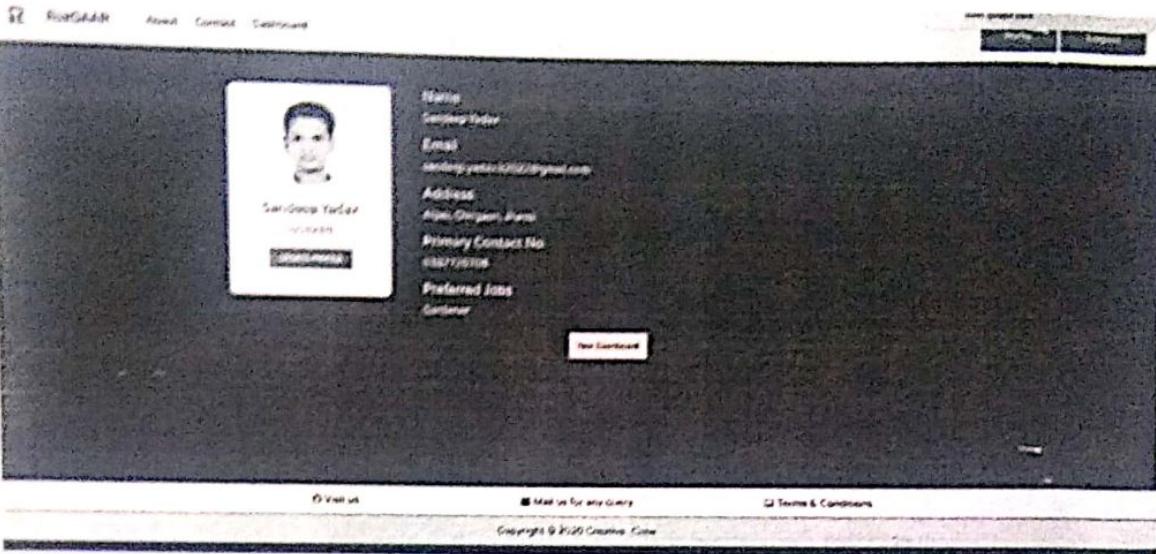
4. /users/jobs: to render jobs made by user (my jobs)

The screenshot shows a dark-themed dashboard titled "My Jobs". At the top, there's a "Add New" button. Below it is a table with columns for "Job Title" and "Description". There are two rows of data in the table:

Job Title	Description
Plumber	

At the bottom of the dashboard, there is a link "Jobs created by User". The footer includes the copyright notice "Copyright 12/2023 Creative_Crew" and navigation links for "RozGAAR", "About", "Contact", "Dashboard", "Profile", and "Logout".

5. /users/profile: to render my profile



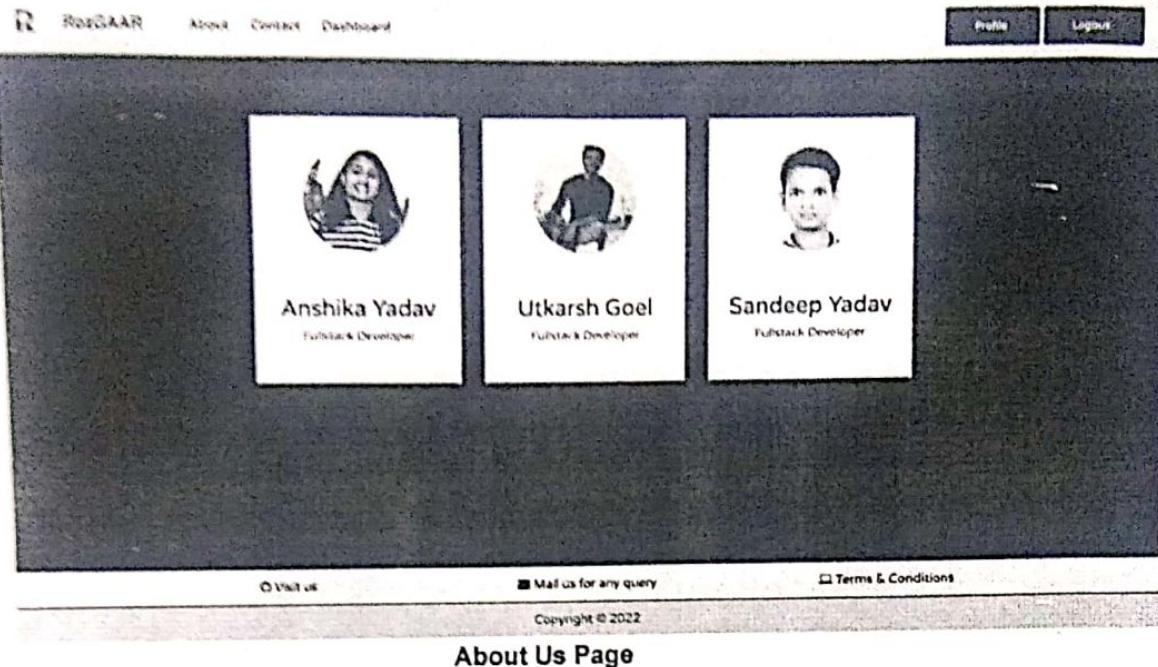
Profile Page

6. /users/profile/update: to render update profile form

The screenshot shows an 'Apply as Worker' form. On the left, there's a 'Welcome' section with a rocket icon and the text 'You are only four seconds away!'. The main form has tabs for 'Worker' (selected) and 'Recruiter'. It contains fields for Name (Sandeep), Email (sandeep.yadav123@gmail.com), Address, and gender selection (Male). There are also fields for Secondary Contact Number and Primary Contact Number. Below these, there's a section titled 'Choose your preferred jobs' with checkboxes for Painter, Watchman, Gardener, and Maid. At the bottom right is a large 'Update Profile' button.

Update Profile

7. /about-us: to render about us /page



About Us Page

8. [/contact-us:](#) to render contact us page

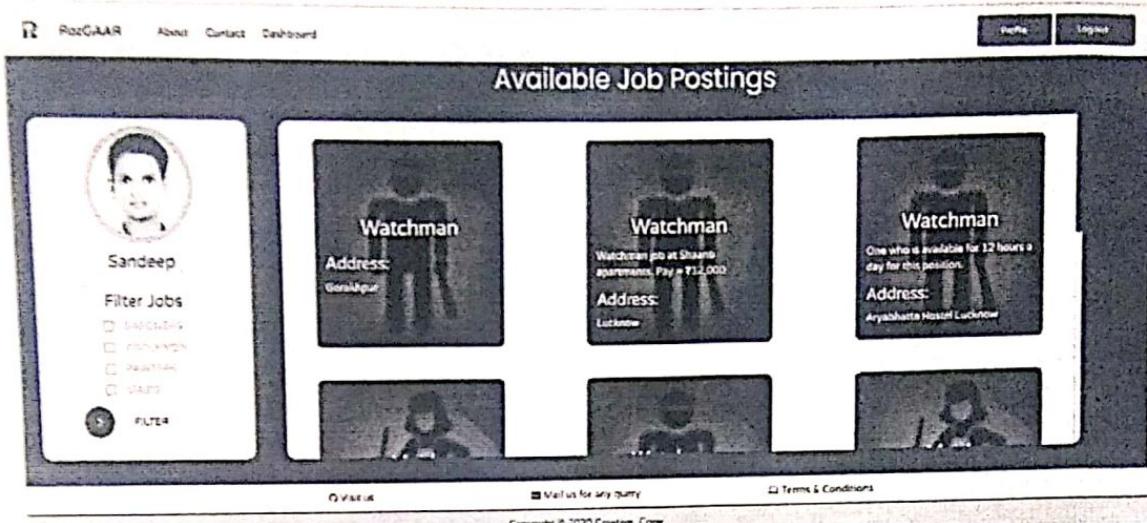
Mail us for any query



Contact Us via E-mail

POST APIs:

1. [/users/dashboard/filter:](#) to filter data on dashboard

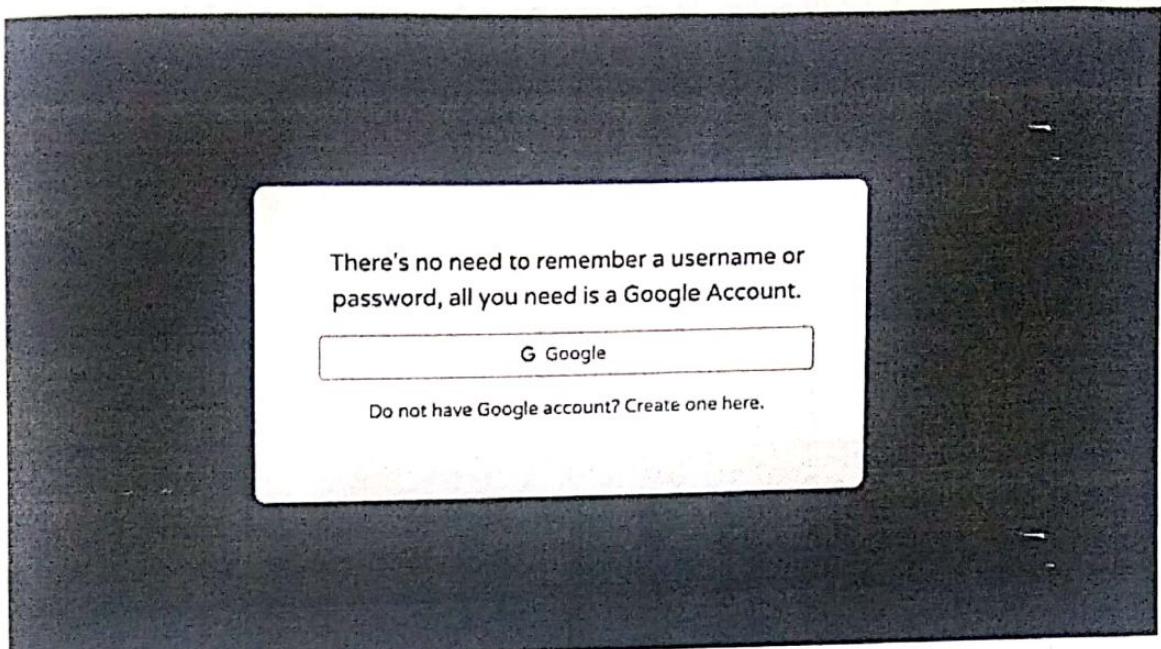


Filter panel

2. /user-recruiter: to make a user recruiter
3. /user-worker: to make a user worker
4. /users: create a new user
5. /users/newjobs/jobs: to create new job for user
6. /jobs/delete: to delete job
7. /jobs: to show all jobs
8. /google: to send user to google for authentication
9. /auth/google/redirect: to handle google redirection

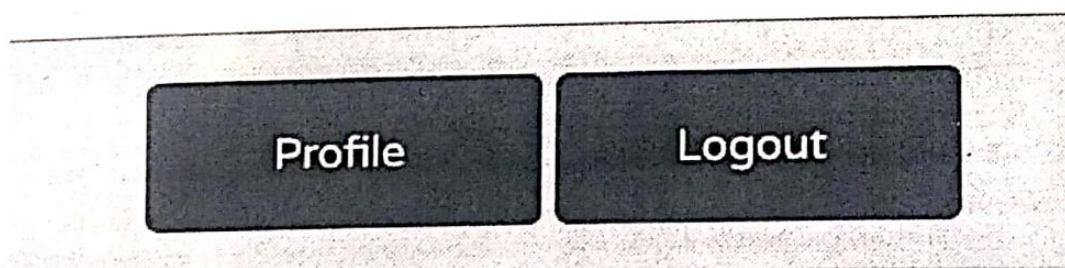
Endpoints:

1. /auth/login: endpoint to login the user



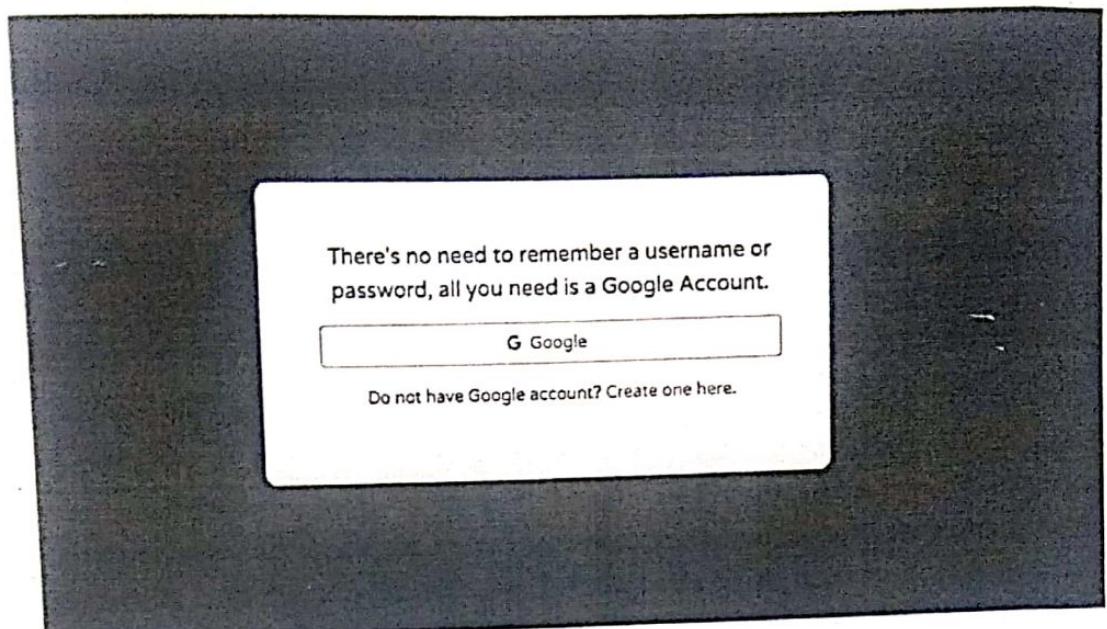
Login Page

2. /auth/logout: endpoint to logout the user



Logout

3. /auth/signup: endpoint to sign-up the user



Sign-up Page

3.5.4 KNN Algorithm

K-Nearest Neighbours is one of the most basic algorithms used for Classification. KNN is a non-parametric algorithm (meaning, it does not make any underlying assumptions about the distribution of data) belonging to the supervised learning community. KNN algorithm can also be used for regression problems. The only difference will be using averages of nearest neighbours rather than voting from nearest neighbours.

In the K-NN algorithm output is a class membership. An object is assigned a class that is most common among its K nearest neighbours, K being the number of neighbours. Intuitively K is always a positive integer. Thus, if K = 1. The object is assigned a class of its nearest neighbour. (Ref-9)

We are using distance-based KNN where distance is being calculated as physical distance between different locations, which has been calculated using Google Map APIs. KNN is a distance-based classifier, meaning that it implicitly assumes that the smaller the distance between two points, the more similar they are.

3.6 Testing and Deployment

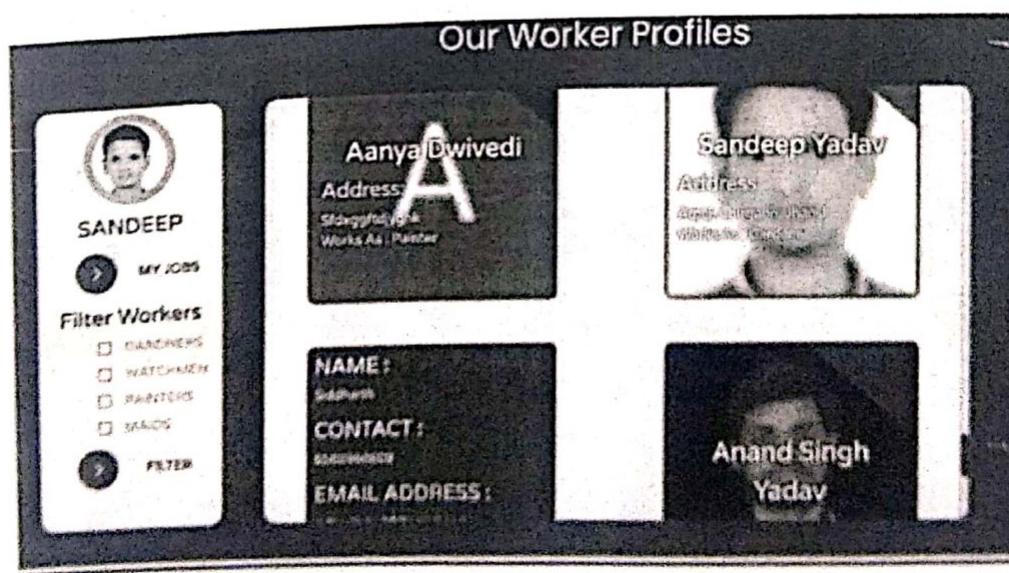
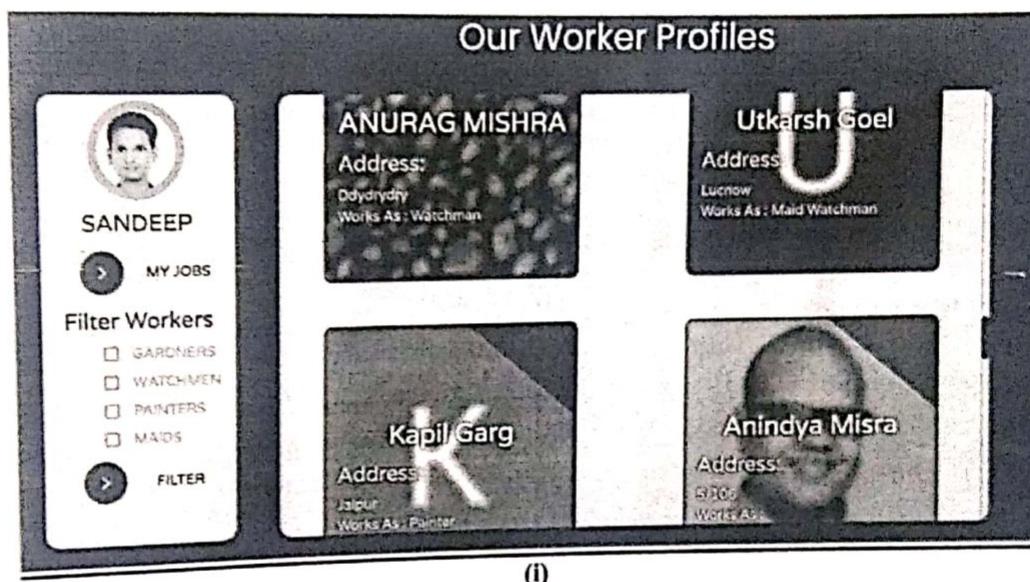
We tested our RozGAAR app by asking people to sign-up, login and create either *worker* or recruiter profiles and hire or get hired through the app for roles like *painter*, *watchman*, *maid*, *gardener* etc. We were able to get 20+ registrations for *worker profile* and *recruiter profiles* and hence we were able to move successfully through the testing phase to the deployment phase.

The project has been deployed on Heroku. (cloud platform as a service supporting several programming languages)

Chapter 4 Experimental Results

During the testing phase, we experimented with our app and kept it open for people to sign-up, login and create either worker or recruiter profile. The below images testify as the results that we received for our RozGAAR application.

4.1 Worker profiles



(ii)

The screenshot shows a dashboard titled "Our Worker Profiles". On the left, there is a sidebar for "SANDEEP" with a profile picture, a "MY JOBS" button, and a "FILTER WORKERS" section containing checkboxes for "GARDENERS", "WALLETIEN", "PAINTERS", and "MAIDS", followed by a "FILTER" button. The main area displays three worker profiles in cards:

- Shivan sharan**: Address: 10F, Wissa Al-1.
- Devi Chindu**: Address: D-101.
- Kumar Yash**: Address: 10F, Wissa Al-1.

(iii)

The screenshot shows a dashboard titled "Our Worker Profiles". On the left, there is a sidebar for "SANDEEP" with a profile picture, a "MY JOBS" button, and a "FILTER WORKERS" section containing checkboxes for "GARDENERS", "WALLETIEN", "PAINTERS", and "MAIDS", followed by a "FILTER" button. The main area displays three worker profiles in cards:

- Ashutosh Kumar**: Address: 10F, Wissa Al-1.
- Tushar Bisht**: Address: 10F, Wissa Al-1.
- Dharveendar Kumar**: Address: 10F, Wissa Al-1.

(iv)

The screenshot shows the 'Our Worker Profiles' section of the RozGAAR website. On the left, there's a sidebar for 'SANDEEP' with options to 'MY JOBS' and 'Filter Workers' (checkboxes for GARDENERS, WATCHMEN, PAINTERS, MAIDS, and a 'FILTER' button). The main area displays four worker profiles:

- Isha Thakur**: Address: 7894561324, Works As: Painter Gardener Maid Watchman
- Dheeraj Bansal**: Address: 336 Udyog Vihar Phase IV, Works As: Painter Watchman
- Varun Saini IET**: Student
- Prabhav Garg**: Address: [partially visible]

(v)

4.2 Job postings

The screenshot shows the 'Available Job Postings' section of the RozGAAR website. On the left, there's a sidebar for 'Sandeep' with options to 'Filter Jobs' (checkboxes for GARDENERS, WATCHMEN, PAINTERS, MAIDS, and a 'FILTER' button). The main area displays three job posting cards:

- Gardener**: Urgent need of a gardener! Address: Gorakhpur
- Gardener**: Experienced gardener needed.
- Gardener**: Need a gardener.

Contact information for the first posting is provided: Search Go!, CONTACT: 7896541598, EMAIL ADDRESS: ukarash.sky99@gmail.com.

At the bottom, there are links: 'View us', 'Mail us for any query', and 'Terms & Conditions'. The footer includes 'Copyright © 2020 Creative_Crew'.

(i)

Chapter 5

Conclusions

5.1 Conclusions

5.1.1 Features of RozGAAR App

1. Google authorization login system; Easy to understand one click login system where the daily wage workers need not to remember their username or password.
2. Job posting service for recruiters; Recruiters can post a detailed job description and accept applications from interested people to choose from.
3. Choice-based dashboard; Recruiters and job-seekers can choose what to see according to their preferences of location, budget/salary, expectations etc.
4. Filter options; Recruiters and job seekers can filter candidates and jobs respectively according to search history and personal preferences

5.1.2 Novelty of RozGAAR App

1. Ease of use; Three-step, one-time onboarding process in order to make the onboarding easy to understand and minimalistic. The dashboard is very easy to use for both recruiters and workers and the content will be rendered in both English and Hindi.
2. No intermediary co-operation required; There is no third-party interference between the demand and supply flows. Recruiters and workers can directly contact each other without worrying about any interference by any external factor/organization.

This also makes it possible for this application to be open to all workers and hence makes it a two-way process.

3. Authentication using mobile number; Along with google authentication, we will also make it possible to authenticate through ones' mobile number using OTP. However, this will pose a limitation at our end since the cost factor to implement the same will be involved.

5. 2 Future Works

1. Adding more job profiles: Inclusion of a broad range of job profiles and fields of work
2. Adding chat services: Incorporating a tool to communicate for the recruiters and candidates directly over the application
3. Adding payment services: Making subscription options available to both recruiters and job-seekers

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