Research Article

DESIGN AND IMPLEMENTATION OF A LOCATION-BASED WEB APPLICATION FOR SKILLED WORKERS AND CLIENTS IN NIGERIA

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ABSTRACT

Nigeria is experiencing a rapid increase in population, which will result in higher demand for skilled labour. Factors such as local needs, market dynamics, property management, and busier lifestyles contribute to this trend. However, accessing these services can be difficult when travelling or relocating to a new area due to the dispersed nature of service providers across the city and variations in cost, quality, and offerings. This poses challenges especially during urgent situations. The main aim of this research Is to develop a responsive web application for locating the nearest skilled workers using the users location to help in streamlining the process of acquiring skilled workers. The application includes a rating and review system which helps users make informed choices. The application lets skilled workers upload photos and details of their past projects. This helps them show off their skills to potential clients and serve as a marketing tool, giving users the option to choose workers based on their past success. HTML, CSS, and JavaScript were used to create the web applications interface. Bootstrap was used to ensure the application is responsive and accessible across various devices and screen sizes. Python and Django formed the core of the back-end. The application's database was managed using Postgre SQL. The Haver sine algorithm was implemented to calculate the distance between the users location and available service providers. The Agile methodology guided the entire development process, supporting a flexible and iterative approach. Testing of the final application was successfully completed by potential users and the developer. According to test results, respondents agreed that the developed web application would effectively address shortcomings in existing systems by locating skilled workers nearby and providing a structured approach for assessing service quality. Users will benefit from easily finding skilled workers' services tailored to their location, meeting the increasing demand for on-demand services.

Keywords: Nigeria; Skilled workers; Web application; Location; Agile methodology.

INTRODUCTION

In every Nigerian's daily life, there is always a possibility of needing a skilled worker or artisan. From routine household tasks to more specialized projects, the demand for skilled labor is ever-present, underscoring the essential role these professionals play in our society. Whether it's fixing a leaky pipe, renovating a home, or repairing electrical wiring, the expertise of skilled workers is indispensable.

A skilled worker also referred to as a handyman, service provider, artisan, maintenance worker, repair technician, or handyperson is proficient in various types of repairs essential for maintaining buildings, shops or household equipment. Their responsibilities encompass trade skills and upkeep tasks often known as "side work", "odd jobs" or "fix-up tasks". In Nigeria, these workers are categorized within the informal sector [1].In the Nigerian con-text, the Bank of Industry describes the informal sector as 'economic activities that are not fully regulated by the government and other public authorities, enterprises that are not officially registered without a complete set of accounts and workers with jobs that lack employment benefits, social or legal protection' [2].

As of 2019, over 500,000 individuals were employed in handyman services, a significant increase from the estimated 259,146 workers in 2011 [1]. This indicates that the growth in the number of skilled workers is on the rise as a result of factors such as population size,

cost of living, unemployment rate, and so on. The demand for these skilled professionals will continue to increase due to unexpected circumstances, local demands, individual needs, and busy schedules. However, identifying these skilled workers has always been a complicated process, particularly when relocating to a new area and being unfamiliar with the surroundings. This could pose a significant problem in an emergency situation. Consider a situation where a person's vehicle malfunctions in an unfamiliar area, and they are unaware of the nearest auto repair shop. Similarly, a household may encounter challenges in locating an available plumber to address a kitchen leak nearby.

Skilled workers need a platform that allows them to show their skills, creating more job opportunities and reaching out beyond online platforms into offline communities. This platform will enable them to showcase their projects, highlight their expertise, and receive reviews from previous customers. The goal of this study is to create a web-based application that uses location services to connect skilled workers with customers in an efficient manner. This platform will allow skilled workers to showcase their services and availability, while also enabling customers to easily locate nearby service providers and assess their quality based on ratings and reviews.

Background

Nigeria has faced several difficulties in its economy in the recent past. The International Monetary Fund estimated a growth of 2.9% for 2023, which closely aligns with the population growth projection of 2.4%. The combination of high underemployment and un-employment rates along with population growth is expected to result in a rise in the number of individuals seeking employment by 2024, leading more people to seek economic survival through informal means [3].

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The informal sector in Nigeria plays a vital role in the nation's economy, making up a substantial portion of both employment and the overall GDP. According to the IMF, it is estimated that in 2017, the Nigerian informal sector accounted for approximately 65% of the country's GDP [4]. [2] asserts that there is an expected growth in the informal sec-tor's contribution to Nigeria's GDP, increasing from 42% in 2015 to a projected 46.11% by 2025. This anticipated rise highlights a need for additional services to support this trend. Consequently, it is of vital importance to prioritize the development of the informal sector in order for it to have a more substantial impact on the country's economic expansion.[5] noted that the tradition of labor has a history tracing back to ancient times when knowledge was passed down through hands on training and guidance from one generation to the next. Artisans, craftsmen and handymen played a role in this process by sharing their expertise with young learners. In the days before colonization, informal apprenticeships were a part of education in various Nigerian communities. Young boys would leave their homes to live with workers for about 3 to 7 years. During this time, they would assist their mentors with tasks while also learning skills and techniques firsthand.

In today's job market, skilled workers and potential clients encounter challenges. Skilled workers often face obstacles such as visibility for showing their talents to an audience and difficulties in finding a reliable platform to connect with potential clients. These challenges can hinder their ability to secure work opportunities and expand their customer base. Like-wise, prospective customers struggle to find skilled and reliable workers for their needs due to the absence of a centralized and verified platform for skilled workers. Another issue faced by customers, is the absence of an assessment and rating system. Customers are at a risk of feeling dissatisfied and receiving services that fall short of their expectations. This could lead them to hesitate in seeking help from professionals even if they could greatly benefit from their service. Proximity is another challenge for clients trying to access ser-vices making it harder for them to locate professionals in their vicinity and impacting the timely and efficient provision of services.

In Nigeria, there is an increasing demand for technological intervention in the informal sec-tor. According to [3], the informal sector is frequently associated with reduced efficiency and restricted technological uptake, which can impede its capacity to fully achieve its potential. Currently, Nigeria is experiencing a substantial digital revolution. This includes mobile banking applications that enable users to conduct money transfers, settle bills, and access financial services effortlessly, as well as e-commerce platforms offering a wide range of products from groceries to electronics. In the banking industry, the use of USSD codes for transactions without internet connectivity demonstrates innovative solutions customized for local requirements. The digital revolution has brought significant changes to different industries, including skilled labor. By 2022, Nigeria's internet user base had reached approximately 84 million people. Projections suggested that this number will increase to 117 million in 2023 [6] highlighting a substantial move towards digitization in the country. The growing accessibility and usage of the internet have direct implications for the demand for digital technology, especially in sectors that have been slow to adopt digital solutions like the informal sector. With more Nigerians having internet access, there is an immense potential for digital platforms to expand their reach and serve a larger audience effectively. A web application could revolutionize the interaction between skilled workers and potential customers by creating a digital marketplace that enhances accessibility, reliability, and market efficiency. By providing a platform where skilled workers can list their services, along with detailed profiles and customer reviews, it significantly reduces the time and effort required for customers to find and vet potential hires. For workers, it opens up opportunities to reach a wider audience beyond their immediate locality, showcasing their skills to an expansive customer base.

Problem Statement

The informal sector in Nigeria is currently facing challenges that are impacting the success of skilled workers and the satisfaction of potential customers. Skilled workers lack a platform to showcase their work, talents and expertise which limits their ability to reach an audience and attract new clients. This lack of visibility restricts their opportunities for growth and professional development as they struggle to expand beyond clientele. When individuals find themselves in new surroundings be it that they are moving to a new city or staying temporarily they often struggle to locate reliable skilled workers. This is due to the fact that they rely on recommendations from others or information found online. Searching for these workers during emergencies can be time consuming. Lack of trust is also a concern; without reviews or ratings it's hard to determine if you are hiring someone competent. As a result, people are unsure about who to hire while skilled workers also face challenges in proving their suitability for the job.

This research aims to address these issues by creating a location-based web application that facilitates connections between handymen and potential clients. The platform is designed to boost development, build confidence through a rating system, streamline the process of hiring workers and increase visibility, for professionals.

Aims and Objectives

Research Aim

The aim of this study is to develop a location-based web application that eases the interaction between skilled workers and prospective customers.

Research Objectives

1) To Identify the challenges faced by skilled workers or handymen in the informal sector in Nigeria.
2) To develop a location-based web application that creates a seamless connection between potential clients and skilled workers that will make accessibility easier.
3) To reduce the time and uncertainty involved in finding skilled workers
4) To enhance the visibility of skilled workers, allowing them to display their skills and past projects to potential customers.
5) To contribute to economic development by easing the process of hiring skilled workers

Motivation

This study is motivated by an urge to support workers and potential clients in the in-formal sector in Nigeria in overcoming major hurdles. These challenges involve difficulties like the effort to attract customers and showcase their skills mainly because there is no way for them to interact with clients. On the other hand, customers often face challenges when looking for skilled workers for help. To tackle these issues this study aims to create a platform that makes it easier for workers and clients to connect with each other.

Interest

This project is motivated by the real challenges encountered by skilled workers and service users within communities. It addresses the difficulties faced by potential customers in locating skilled workers and the frustrations experienced by service providers in offer-ing their assistance reliably and promptly. The development of an innovative solution to mitigate these issues is a key focus of this initiative. Creating this platform could have an impact on the economy and enhance the quality of life for individuals. By leveraging location-based services, which have already shown their value in areas, the aim is to facilitate easy access for people to connect with skilled workers in their area. This feature can be particularly handy, for emergency solutions or urgent help.

Significance

This research is aimed at enhancing the country's economy through the establishment of a unified platform that facilitates easy connections between individuals and skilled workers. This will help increase income levels, and enhance overall economic conditions. The study centers on developing a location-based platform that will help enhance the connection between skilled workers and potential clients. It includes a special feature for locating nearby skilled workers during emergencies, thereby proving highly valuable in urgent scenarios. This research could shine a spotlight on the informal sector, an area that hasn't received enough focus yet plays a crucial role in the economy. By developing a platform like this, it highlights the value and potential of informal workers, drawing much-needed attention to their contributions. This might encourage more support and investment in the sector, helping to improve working conditions and opportunities for countless individuals. This project not only addresses existing gaps but also provides groundwork for future studies towards better solutions in the informal sector.

Scope and Limitations

Scope

1) The research will focus first on areas in Nigeria that typically have a need for specialized services.
2) The web application developed from this study will include service categories, such as plumbing, electrical work, carpentry, painting, hairstyling, tailor, and technician amongst others.
3) The system will be compatible with all internet browsers e.g. Chrome. Firefox, Edge, Safari and will be responsive making sure that it can be used on a variety of devices.
4) This platform will include features like ratings and reviews and communication tools.
5) The web application will make use of technological features, such as API's and algorithms that will be used to assist in finding nearby qualified workers during emergencies and for enhanced accessibility overall

Limitations

1) The platform's efficiency might be tampered with by internet challenges, especially in rural or less developed regions where high-speed internet access may be nonexistent.
2) Low levels of digital literacy among specific user groups could impede the usability of the platform. Steps will be taken to ensure that interfaces are easy for all users to navigate.

3) While the goal of the platform is to link users with local skilled workers, some ser-vices may not be accessible because of limited availability or geographical limitations.
4) Verifying the excellence and dependability of service providers featured on the plat-form could present a difficulty. Although user feedback and ratings can assist in addressing this issue, there may still be occurrences of inadequate service provision.
5) The platform will manage sensitive user information like personal data, requiring strong security measures to prevent data breaches and cyber attacks. Ongoing monitoring and regular updates will be essential to deal with changing security risks.

Contribution

This study centers on creating a web application that connects skilled workers and potential customers seamlessly. The platform integrates user location functionality, allowing users to easily locate nearby skilled workers. This emphasis on ease-of-use and accessibility significantly contributes to the overall effectiveness of the project. It was developed using Django, HTML, Python, CSS, JavaScript, and PostgreSQL.

Thesis Structure

Chapter one provides an initial overview of the project, discussing the background of the informal sector. It also introduces the problem statement and its proposed solution, Furthermore, it outlines the aims and objectives of the study alongside addressing the motivation, interest, and significance of the project. Further emphasizing why a new system needs development and implementation. Additionally, it discusses both scope and limitations before concluding.

Chapter two discusses the current research on local skilled workers and previous work related to systems. It also examines relevant literature on location based services, informal sector, the challenges faced by skilled workers and service seekers, as well as the existing platforms and previous technological solutions for connecting users with skilled workers. This chapter also includes conceptual and theoretical framework used in the study.

Chapter three explores the Agile Methodology used to develop the web application. It discusses integrating Agile into the Software Development Life Cycle to improve project flexibility and effectiveness.

Chapter four provides an in-depth analysis of the web application development process, focusing on requirement analysis. It emphasizes the agile methodology for its adaptability and user-centric approach. The chapter outlines the application's functional and non-functional requirements, It also addresses potential risks and conducts a feasibility study, evaluating the project's economic, technical, and socio-economic viability, aiming to enhance accessibility, quality of life, and employment opportunities through the platform.

Chapter five consists of the design aspects of the web application, outlining the transition from specific requirements to actionable specifications for development. This phase includes system architecture, creating user interface blueprints and database layouts. The chapter also discusses the use of the Haversine algorithm for location-based functionalities and details the website flowchart representing the website's navigation flow, highlighting the user's journey from one task to another.

Chapter six focuses on the implementation, deployment and testing phases of the web application. The chapter details unit and integration testing strategies to verify individual components and their interactions, emphasizing functional testing to ensure all features are working properly from a user's perspective. Performance and usability testing were con-ducted to assess the application's efficiency.

Chapter seven wraps up the study by discussing the limitations, suggesting areas for future work, and concluding the findings.

LITERATURE REVIEW

Location-Based Services (LBS)

Location-based services involve using the geographical position of a device to offer a range of applications and solutions, including guidance for navigation, targeted advertising based on location, and identifying specific places [7]. LBS may also be described as computer programs that provide customized information based on the device and user's location and circumstances [8]. [9] explains Location-Based Service as a system that filters information based on location, allowing an application to offer more targeted information to users. He also notes that the Global Positioning System is required to pinpoint the user's location for the service to work effectively. Location-based services have been avail-able since 2000, predominantly used in commerce with a subscription-based model [10]. By leveraging technologies such as Radio Frequency identification, Bluetooth, Near Field Communication, wireless networks, and Global Positioning Services, specific information tailored to the user's location can be delivered efficiently.

Advantages of Location Based Services

1) Location-based services provides security for consumers during emergencies. For in-stance, customers can conveniently request roadside assistance, and emergency medical services can promptly arrive at the scene in the event of an accident.
2) Enhance the customer journey by utilizing LBS to provide customers with tailored content and services according to their location, instead of bombarding them with generic advertisements and marketing promotions.
3) Location-based services enable businesses to gain insight into their customers' purchasing behavior, including foot traffic, visit times, offer utilization, and other relevant data.
4) LBS enables businesses to alert nearby customers about ongoing promotions and exclusive gatherings.
5) Location-based applications can also benefit from feedback and evaluations as they have the potential to draw in fresh clientele.

The items listed above are derived from [11].

Disadvantages of Location Based Services

1) LBS app users continue to prioritize privacy as a key issue. Regrettably, certain businesses may be negligent in their handling and distribution of customer data, resulting in data breaches and unauthorized disclosure.
2) The impact of a VPN and various considerations on determining the customer's location.
3) The risk of being overshadowed by the proliferation of other LBS apps.
4) Heightened susceptibility to becoming irrelevant if the user frequently moves or travels.

The items listed above are derived from [11].

Informal Sector

[12] describes the informal sector as a sector that encompasses economic activities or income sources that are not fully regulated by the government and public authorities. This includes unregistered enterprises without complete accounting records, as well as workers in jobs lacking basic social or legal protections and employment benefits. Informal job examples include street traders, subsistence farmers, small-scale manufacturers, ser-vice providers like hairdressers, private taxi drivers, and carpenters. Currently, this sector represents over 50% of global employment and up to 90% of employment in certain less developed countries.

Challenges Faced in the Informal Sector

1) Financial Services: Access to formal financial services is restricted, leading to many small-scale entrepreneurs working within a cash-based economy. This not only hinders their capacity to save and invest but also leaves them vulnerable to financial risks [3].
2) Inadequate Infrastructure: The lack of adequate infrastructure poses a significant barrier to the informal economy. Inadequate transportation, unreliable access to power, and limited essential services can impede the growth of businesses and constrain their operations [3].
3) Economic drivers: These include high or inflexible tax systems that pose challenges for entrepreneurs. Moreover, a sharp economic decline and decrease in national GDP due to local recession contribute to the growth of informal employment [13].
4) Business challenges: This include external competitive pressures impacting small-scale survivalist businesses. Furthermore, strong market competition and a rise in self-employed workers or contractors may also present significant hurdles [13].
5) Socio-demographic and socio-environmental constraints: this includes rising unemployment, extensive poverty rates, restricted educational and training opportunities (including vocational and apprenticeship programs for formal employment), as well as prevalent governmental corruption [13].
6) Governance: Governance aspects comprise heightened regulations that hinder the operations of informal sector workers on the streets, in addition to minimal government investments in the informal sector [13].
7) Science and technology: The impact of science and technology can either decelerate or bolster growth within the informal sector. Integrating technology has the potential to enhance visibility, profitability, and partially formalize micro-enterprises [13].

Impact of the Informal Sector on the Nigerian Economy

The informal sector offers job prospects, creates revenue, and encourages entrepreneur-ship, exerting a significant impact on the Nigerian economy. Typically, it offers employment with wages lower than the average for basic sustenance, and those working in this sector predominantly operate at a subsistence level [3].

Skilled Workers

According to [14], a skilled worker is a subset of the labor force with advanced expertise that contributes substantial economic worth through their work. This category typically entails extensive experience and specialized knowledge, encompassing complex responsibilities that demand particular skill sets, education, training, and practical know-how, often involving conceptual reasoning [15]. A skilled worker necessitates a degree of expertise and instruction that

does not necessarily involve higher education. Examples of skilled workers include electricians, plumbers, painters, carpenters, masons, steel fixers, tilers, plant operators, welders and mechanics [16]. These workers have undergone training or completed apprenticeships to develop expertise in specific trades or professions. Their hands-on skills and technical know-how might have been gained through formal education programs, on-the-job training initiatives, or years of experience in their respective fields.

Challenges Faced by Skilled Workers

1) Strong customer base: Any skilled worker requires a solid customer foundation in order to thrive. This involves not only attracting customers but also retaining their loyalty over time. The competition in the informal sector is intense, with numerous skilled professionals available on various platforms even within a limited geographic area. Customers may choose to use the services of others if they are offered cost-effective solutions.
2) Seasonal tasks: Skilled workers often encounter challenges due to the periodic variation of specific tasks, resulting in significant impacts on their business growth. This limits skilled professionals from securing service opportunities only at certain periods throughout the year.
3) Lack of Understanding: Skilled Workers often go into the sector without a comprehensive understanding of the skills required for their customer base.
4) Improper Maintenance: Skilled workers often face considerable difficulties when it comes to maintaining and repairing their varied array of tools and equipment necessary for carrying out their tasks. The breakdown or maintenance needs of these tools can lead to job delays, resulting in financial losses. Moreover, the expenses associated with repairing or replacing equipment can be substantial, especially if a business must acquire new tools or engage external contractors for repairs.
5) The minimum price rate for the services: Skilled workers encounter another dilemma when determining the minimum price for each service. It must strike a balance, being neither too high to deter customers nor too low to impact business profits and expansion. Customers are reluctant to pay higher prices for these services, posing a challenge for the company's profitability. Increasing the price of the service may prompt customers to switch quickly to a competitor offering similar services at lower rates.

The items listed above are derived from [17].

Challenges Currently Faced in Acquisition of Skilled Worker Services

Locating handyman services can be a daunting task, especially when moving to a new area. These service providers are situated across different locations and vary in terms of cost, quality, and the type of service they offer. In emergency situations such as car breakdowns or plumbing and electrical issues, immediate access to these services is crucial for individuals' safety. Another issue lies in determining the quality of services provided by handymen who operate as small businesses. Potential clients often underestimate the ability of small businesses to deliver high-quality services. This misconception can lead to higher costs and increased risks if poor services are rendered, necessitating hiring another handyman for the same job [18].

Technological Barriers and Infrastructure Limitations in Nigeria

1) Poor service from Internet Service Providers: ISP's pose a significant obstacle to the efficient use of ICT. This issue arises from a lack of adequate infrastructure, such as network backbone and fiber-optic networks for wide area connectivity, which are crucial for interconnectedness [19]. The insufficient and unreliable internet connections lead to challenges in effective communication with clients, suppliers, and other stakeholders. Additionally, subpar internet services impede the online marketing efforts of skilled workers and artisans who depend on online platforms to showcase their expertise, present portfolios, and attract potential customers. If their websites or social media profiles load slowly or face downtime due to ISP issues, it can re-duce their visibility online and ultimately affect their ability to secure new business opportunities.
2) High Cost: Small and medium-sized enterprises face obstacles in adopting ICT due to its high expenses [20]. This also impacts proficient laborers who rely on dig-ital platforms for communication, advertising, accessing resources, and delivering remote services. The costs associated with procuring and managing essential technology hardware, software, and other information and communication technology can create challenges for individual skilled workers or small businesses.
3) Lack of skills: There is a shortage of essential ICT skills among workers [20]. A significant challenge arises from the limited proficiency in digital skills, hindering professionals and skilled workers from fully exploiting digital platforms. This lack of expertise can impede their capability to embrace technological advancements and keep up with evolving industry trends.

The Benefits of Using a Location Based App for Finding Skilled

Workers

1) Improving Brand Perception: The software typically enhances online presence, al-lowing employees to reach a wide audience. This contributes to brand development, ultimately resulting in increased business and profits [21].
2) Locate Nearest Home Repair Services: Consumers seek more convenient home maintenance services that align with their hectic schedules. Thus, it is evident that they are particularly interested in locating nearby handymen. These location-based applications offer a strong capability for customers to access details about workers available in their vicinity [21].
3) Location Monitoring: Through the use of a handyman application, both clients and technicians can monitor each other's whereabouts using GPS technology. This allows customers to easily determine the exact location as well as an estimated arrival time of skilled professionals [21].
4) Flexibility: These applications also provide workers with a high degree of flexibility that is challenging to replicate. They have the option to accept tasks that align with their availability, skills, and preferred areas. This selective method allows workers to work more effectively and achieve a improved balance between work and personal life. They can determine how much they want to work, taking charge of their work-load and potential income, which can be particularly beneficial for self-employed contractors or small business operators [22].
5) Importance of After-Service Experience: Ensuring customer satisfaction is equally important in the post-service experience. Allowing users to provide feedback creates

a direct channel for them to share their opinions on the service they have received. This open line of communication between customers and the service provider con-tributes to maintaining high standards and accountability. Constructive feedback aids professionals in enhancing their services, while positive reviews contribute to building a strong reputation within the app community [22].

The Impact of Location Based Services on Skilled Labor

The application of LBS in finding artisans goes beyond mere convenience, contributing to a more sustainable and community-focused economic model. Individuals often en-counter difficulties when attempting to locate skilled workers, particularly when relocating or dealing with urgent issues like electrical failures or plumbing crisis. These challenges can lead to delays in obtaining services and potentially result in more serious consequences such as fires if not promptly addressed. Utilizing Location-Based Services can enhance the convenience and effectiveness of locating nearby service providers, possibly increasing their visibility and accessibility to local customers.

Existing Work

U. Onu Fergus and O. Ogbunude Festus collaborated to tackle the challenge of connecting artisans with potential clients, especially those new to a city in need of their ser-vices. Recognizing the lack of visibility for people seeking their help despite artisans' significant contributions to the economy and society, they developed an online platform called "Artisans Connect." This digital system features functions such as an online directory of categorized artisans, a secure online payment gateway, as well as modules for subscription updates and community engagement [23]. Rifqi Muhammad Nafis and Eko Budi Setiawan developed a system that streamlines the scheduling and booking of handyman services by integrating webhook technology with Google Calendar API for real-time updates and notifications. This system serves as an intermediary between clients and service providers, improving efficiency and customer satisfaction. The research focused on addressing common booking challenges faced by both parties [24].

In the "Service Booking Application" research, [25] developed an online platform called Serve Go for consolidating home maintenance and repair services. This application facilitates the booking of various services such as electrical and plumbing repairs, along with other home maintenance tasks. It was designed to serve as an all-in-one platform for users to easily connect with skilled service providers and promote their services online. To enhance user experience and improve service delivery, Serve Go integrates several important modules including notifications, status updates for bookings, online payment processing, service ratings, service requests, and GPS location tracking.

The researchers Ogunrinde *et al.,* concentrated concentrated on developing a platform where all handyman service providers can showcase their services, and clients can quickly request and hire one. To achieve the work, an iteration model was employed, the design was created using Draw.io, HTML, CSS, Bootstrap, JavaScript, PHP and MySQL were used to design the platform [1].

Gikundi's research centered on creating a mobile app designed a mobile application for locating handyman service. The primary objective was to respond to the rising need for dependable and effective handyman services, particularly among individuals with increasingly hectic schedules. Using technological tools, the app sought to overcome shortcomings commonly found in current systems that often lack reliable information regarding the quality of such services. Through elements like a rating system and integration of work history, the application aims to cultivate trust between customers and service providers [18].

Researchers Allyssa A *et al.,* sought to tackle the common difficulties faced in accessing local handyman services in Metro Manila by creating a mobile app called Handy Fix. This innovative tool aimed to offer users a reliable and organized way of finding, communicating with, and making payments for handyman services in their specific locality. Given the challenges associated with verifying handymen's expertise and overcoming location-related obstacles such as high transportation expenses and delays, the study incorporated features like location-based functions, user-friendly scheduling choices, and image-based issue re-porting [26]. Sheetal Bandekar and Avril D'Silva created a corporate mobile app for Android users to connect clients with service providers for home services using GPS technology. The app pairs clients with the nearest available service provider based on their location [27].

[28] developed an application called "Android solvotech". It operates on the Android plat-form and aims to improve communication between consumers and local technical professionals, including painters, electricians, mechanics, and plumbers. Through harnessing the capabilities of smartphone technology, "Android solvotech" streamlines the process of hiring skilled workers for repair and maintenance jobs with the goal of increasing employment opportunities and simplifying service procurement for property and office upkeep. The app uses real-time databases and push notifications to link users with nearby service providers. Kelly Foo Yen Li and Norfaradilla Wahid developed an Android-based application named Service Finder to streamline the process of locating and scheduling local services. The app allows users to search for nearby services such as plumbing, electrical repair, car repairs, trailers, and cleaning services using a location-based approach. It leverages tools like An-droid Studio for development and MySQL for database management while offering modules for profile management, account handling, service browsing, appointment scheduling, and a rate-and-review system. The research involved analyzing current systems, identifying the need for easier ways to contact service providers, and evaluating user acceptance of the prototype. This digital platform serves both consumers and businesses by providing location-specific suggestions that add value to their needs [9].

Hegde *et al.,* developed an Android Application for Home Services which is a home services application designed specifically for the Indian market. The app aims to enable customers to connect with nearby service providers for a range of household tasks, addressing the in-creasing demand for convenience in the busy lives of contemporary Indian urban dwellers. It offers a marketplace for services like plumbing, air conditioning maintenance, and over-all household upkeep, emphasizing effectiveness and availability for city residents who are short on time [29].

Bernard Shibwabo Kasamani and Denis Gikundi aimed to address the challenges of accessing handyman services. Current options offer fragmented contacts online with no organized method for evaluating service reliability and whereabouts. The mobile app created is for locating handyman services within a locality to help in streamlining the process of finding handymen. The application was developed in android operating system because of its popularity among many mobile users [10].

The authors of "Renovate-It" have identified a gap between local technical service providers and customers in need of home and office repairs. To address this issue, they developed an Android-based app and website called Renovate-It with the goal of closing this communication gap through the widespread use and functionality of smartphones. The proposed system incorporates Google Maps for geo-based searching and hiring, showing users the proximity of service providers. Additionally, it features instant notifications to facilitate efficient interaction between customers and workers such as plumbers, electricians, mechanics, and decorators. Renovate-It is a

digital initiative designed to simplify the process of finding technicians while also enhancing local employment opportunities by capitalizing on the increasing use of mobile technology in the region [30].

Gaps in Literature

While previous studies showcase noteworthy progress, they also identify a substantial gap: the insufficiently explored opportunity of real-time, location-based web application service discovery in Nigeria. Despite recognizing the significance of handyman services and the difficulties in accessing dependable and affordable services, existing literature does not adequately examine how geolocation technology can improve the matching process within Nigeria's diverse geographic and socio-economic context. This disparity emphasizes the requirement for research on location-based applications that account for local intricacies with the goal of enhancing efficacy and dependability in linking skilled artisans with clients seeking their services.

Theoretical Framework

The theoretical framework consists of a carefully constructed and interconnected collection of principles and fundamentals, derived from one or more theories, designed to underpin a study. As defined by [31], the theoretical framework is a grouping of associated concepts used to guide research with the aim of predicting and elucidating study outcomes [32].

In this study, we investigated the Technology Acceptance Model as a conceptual framework for comprehending the determinants impacting the acceptance and utilization of our web platform created to link prospective customers with skilled workers. The model has been developed to illustrate how individuals adopt and utilize a technology.

The theoretical foundation is established on the idea that three primary factors impact users' choices regarding the adoption and utilization of new technology. The initial factor is its perceived utility, followed by the perceived ease of use, and lastly, the user's attitude to-wards usage [33]. According to [34], perceived usefulness refers to the degree to which a user feels that utilizing a specific system would improve work performance [33]. The importance of Perceived Usefulness in this study refers to how much users perceive that using our web application improves their efficiency in finding skilled workers. This is especially significant as the main purpose of our platform is to simplify the process of linking users with skilled workers.

Perceived ease-of-use refers to the extent to which a user perceives that utilizing a specific technology would require minimal effort. In simpler terms, it is how consumers view a technology as superior to its alternatives [33]. Ensuring the platform is intuitive and user-friendly is crucial due to the diverse user base. Our development process, which follows Agile methodology, enables iterative testing and improvement with a focus on making the application easy to access and navigate. [35] mentioned that the perceived usefulness and perceived ease of use have a positive impact on users' attitudes toward technology usage [33]. In our research, we aim to evaluate users' general perceptions of the web application.

To thoroughly examine these aspects, we utilize usability testing as a crucial approach. This method enables us to observe actual users engaging with the application in real-life situations, offering valuable insights into user experience such as ease of use, effectiveness, and overall contentment.

Conceptual Framework

The conceptual framework represents the research being undertaken, either through narrative or graphical means. It includes the study's dependent, independent, and some-times intervening or control variables, as well as the expected connections between these variables [36]. It equally represents the significance of the research being conducted and the suitability or pertinence of the approaches for conducting the study [37]. Following the definition provided, the conceptual framework for this study can be seen in Figure 2.1.

1) Market Need and Demand: At the core of the framework is the recognition of a significant market need for skilled labor and the demand from potential clients for easier access to these services. This need comes from the current inefficiencies in the market, where clients struggle to find reliable skilled workers, and workers find it challenging to reach a broader client base.

2) Technology Adoption and Digital Literacy: Next, is the context of technology adoption and digital literacy in Nigeria, which influences the feasibility and effectiveness of a digital solution. With increasing internet penetration and mobile device usage, there's a growing acceptance and readiness for digital platforms.

3) Digital Platform Development: This component involves the actual development of the web platform, based on principles drawn from software engineering, user-centered design, and agile development methodologies. It includes the selection of a technology stack (e.g., Python, Django, HTML, CSS, JavaScript, Bootstrap, Post-greSQL) and the design of platform features such as user registration, profile management, search functionality, and real-time location services.

4) User Interaction and Experience: An important part of the framework, is the inter-action between skilled workers, clients, and the platform. This includes how users navigate the platform, the process of finding and booking services, and the mechanisms for feedback and reviews. The user experience (UX) design aims to make these interactions as intuitive and efficient as possible.

5) Economic and Societal Impact: This layer of the framework considers the broader impact of the platform on Nigeria's economy and society. This includes job creation for skilled workers, improved access to services for clients, and the potential for the platform to contribute to economic growth and societal progress.

6) Feedback Loop: A crucial part of the framework is the feedback loop from users back to the platform development and improvement process. User feedback and data analytics inform ongoing enhancements to the platform, ensuring it remains responsive to user needs and market changes.
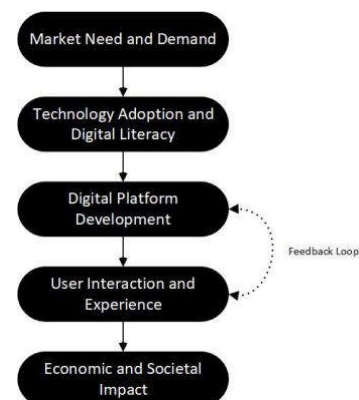

Figure 2.1: Conceptual Framework

METHODOLOGY

Agile Methodology

The agile approach to software development focuses on iterative processes, dividing the method into brief and manageable segments known as sprints. This methodology pro-motes increased participation of customers and stakeholders during the development phase, allowing them to offer feedback and continuously modify priorities. Unlike conventional approaches such as the waterfall model, it advocates for short incremental release cycles rather than prolonged ones, facilitating a more interactive environment where stakeholders can actively contribute [38]. An illustration of the iterative cycle of the Agile Methodology can be seen in Figure 3.1.
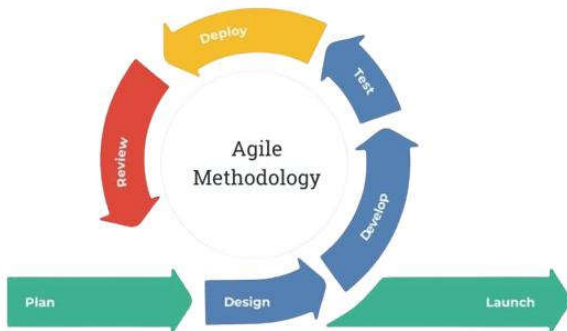
Figure 3.1: Agile Phases

Agile Methodology Relevance

The choice to implement the agile approach in this study was influenced by its core values of improvement, emphasis on user needs and flexibility in responding to changes. These principles closely match the objectives of the research endeavor. The Agile approach facilitates the identification and resolution of industry-specific challenges ensuring that the platform evolves in response to user needs and preferences, and enables ongoing assessment of its effectiveness in enhancing service accessibility and satisfaction. Furthermore, Agile's flexibility makes it well-suited for proposing innovative solutions aimed at improving economic growth and efficiency.

Integration of Agile with SDLC

Integrating Agile methods into the Software Development Life Cycle combines the structured, phase-driven approach of conventional SDLC models with the iterative nature of Agile practices. This combination ensures that software development processes are methodical yet flexible, enabling projects to swiftly adapt to evolving requirements while up-holding a well-defined project framework. The Software Development Life Cycle is a systematic process used to plan, create, test, and deploy an information system, which may include both hardware and software components. The software development life cycle includes various stages that manage the creation, launch, and upkeep of a software product. It also encompasses important elements such as project planning, design, and testing necessary for the engineering process [39]. The phases of the Software Development Life Cycle are comprehensively outlined in Figure 3.2 .

Figure 3.2: SDLC Phases

Planning

This phase involves the development, assessment, and communication of a detailed plan to stakeholders after defining the system concept and project. Planning usually takes place after a group of businesses or sponsor identifies an innovation or initiative, recognizing the need or opportunity. In the planning phase, parameters and constraints for concepts are set. Senior team members will carry out product feasibility studies in financial, operational, and technical aspects with input from business users [39].

Requirement Analysis

The Requirements Analysis phase holds great importance in the software development process, serving as the stage where user requirements for the system are collected and documented. In Agile methodology, since requirements may not be completely gathered initially, close collaboration with business users becomes crucial for gathering feedback after each release. [39].

Design

Throughout the Design phase, detailed requirements develop into precise instructions for engineers to implement during the Development stage. These directives should clarify how functional, physical, interface, and data requirements will be handled within the system. [40]. Agile methodology involves a minimal focus on comprehensive software design due to the prevailing uncertainty. Designers prioritize the current build, ensuring that all builds remain in line with the defined scope outlined in Business Case Documentation. The Software Requirement Specification and Design Specification Documentation are intended to be brief and clear in articulating the components of the current build [39].

Implementation

The objective of this phase is to transform the designs from the Design phase into a working system. This involves developing the necessary software and establishing the infrastructure required for overall system operation, including hardware, software, and communication systems. [40]. Programmers often enjoy more flexibility when implementing Agile Model due to concise documentation provided. Nevertheless, they must still adhere strictly to coding standards. Functional Specification typically addresses core functions while overlooking details [39].

Testing

The purpose of the testing phase is to confirm that the specifications document's requirements have been met. At this stage, it is recommended to incorporate three different types of tests: integration testing for subsystems, security testing, and user acceptance testing. Each type fulfills a specific role and helps stakeholders pinpoint system weaknesses before deployment [40]. In agile methodology, testers bear a significant responsibility because of the limited information available in the documentation, particularly for quality control experts. Business users often conduct testing at a high level or sometimes exclude them entirely from the Testing Phase [39].

Deployment

During this phase, the system is activated in the production environment. It is important to communicate any possible alterations to users before implementation and offer training for professionals if needed. A post-implementation assessment is frequently con-ducted to verify that all requirements are met and the system functions as anticipated in a real-world setting. Upon meeting all requirements, the development team and the client's project manager formalize a contract to confirm that the system has been successfully completed and transferred [40].

Maintenance

The majority of the expenses incurred during the development process originate from the operations and maintenance phase. This phase encompasses activities such as identifying system operations, handling data, addressing issues, and revising documentation that has undergone additional scrutiny (e.g., security evaluation). Moreover, a User-Satisfaction report might be generated during this stage to identify any potential user-related issues for future development cycles [40]. For Agile methodology, this phase is not required as the next build is imminent and can be incorporated in the upcoming iteration [39].

ANALYSIS

Requirement Analysis

Analysis in the software development process is often associated with the Requirements phase. It involves breaking down requirements that have been gathered into specific details, which lays a foundation for the product's design phase [41].

Detailed Description of the Problem the Web Platform aims to Solve

The service industry in Nigeria faces challenges that hinder skilled workers from effectively connecting with potential customers and vice versa. One key issue is the lack of a user platform for discovery and interaction, between service providers and those seeking their expertise. This lack of efficiency makes it difficult for clients to locate professionals particularly in urgent situations. Skilled professionals often face challenges when trying to market their services and reach customers affecting their reputation and financial opportunities. The lack of a feedback mechanism creates trust issues for clients making it difficult for them to choose the right professional. These issues not only disrupt business transactions but also influences the sectors economic well being. This research suggests creating a plat-form centered around location to tackle these challenges. The platform will use geolocation technology to make it easier to find workers in order to meet a customer's urgent needs and open up more opportunities

for these workers. Moreover, including a review system aims to build trust with clients by allowing them to share feedback and help others make informed decisions.

Importance of Addressing These Issues Faced by Users and Skilled

Workers

It is important to tackle the challenges faced by customers and skilled workers in Nigeria for some reasons. For clients, the challenge of locating trustworthy and skilled personnel not only causes frustration and wasted time but also frequently leads to unsatisfactory ser-vice outcomes. In urgent or time-critical scenarios, the inability to promptly find nearby professionals can worsen the pressure and inconvenience faced by customers. By resolving this issue, clients will have better access to a more effective, dependable, and fulfilling approach to fulfilling their service requirements, thereby improving their overall quality of life and confidence in the domestic services industry. Skilled professionals face significant challenges in promoting their services, reaching potential clients, and growing their businesses due to current market inefficiencies. Many rely on word-of-mouth or informal networks to find work, limiting their visibility and opportunities for economic advancement. Creating a dedicated platform not only boosts their market presence but also opens avenues for professional growth, better income stability, and increased job satisfaction. Additionally, the inclusion of a review system serves as a vital feedback mechanism that enables professionals to build reputations, foster trust with customers, and attract more business based on the quality of their work.

Requirements

The requirement can be described as a general abstract statement or a precise mathematical functional specification of the services, functions, and limitations of a system. These descriptions outline the features and operations of the intended system. Requirements represent what users anticipate from the software product. They should allow for interpretation while also being sufficiently detailed to comprehend [42].

Types of Requirements

Functional Requirement

Functional requirements are related to the expected operation of the system, described in terms of system capabilities or the features it is intended to offer users. These requirements can also be portrayed through usage scenarios that outline the series of steps from taking inputs and processing them to generating outputs. Functional requirements are closely linked to meeting user needs and therefore have a crucial role in determining the quality of a product. Their extent can vary widely depending on the specific problem area. The importance of considering functional requirements is particularly emphasized in web applications; for example, in a hospital management system, it should be feasible for a doctor to efficiently access their patients' information [43].

The study's functional requirements have been developed with the Agile approach in mind, ensuring flexibility and adaptability in the development process. They are as follows:

1) User Registration and Authentication

- Users should be able to create their accounts using email addresses and pass-words.
- Skilled workers should be able to register, providing relevant credentials and skills information.
- Secure login/logout functionality for all users.

2) Profile Management

- Users and skilled workers can create and edit their profiles, including personal information, skills, previous works and services offered.
- The skilled workers should be able to have an availability status that they can change

3) Search Functionality

- Ability for users to search for skilled workers based on various criteria such as occupation and the results being sorted by location and ratings should be available.

4) Ratings and Reviews

- Users should be able to rate and review skilled workers after using their ser-vices.
- There should be a display of average ratings and recent reviews on skilled workers 'profiles.

5) Real-time Location Services

- Allow skilled workers to input their geographic coordinates (longitude and latitude) when setting up or updating their profiles. This information will be used to display their location to users within the platform.
- Directions and distance to the skilled worker's location from the user's location using Google maps and an algorithm respectively should be made available.

6) Communication Features

- There should be an option to contact skilled workers directly via phone call or WhatsApp from their profile.

7) Administrative Panel

- There should be a dashboard for administrators to manage users, skilled workers, and content on the platform.
- There should be provision of a tool for monitoring activity, managing disputes, and generating reports on platform usage.

8) Contact Support

- There should be a support section which will contain the contact details of the customer service.

Non-Functional Requirement

These requirements are recognized as the typical constraints that must be satisfied by the system to fulfill the project agreement. However, the extent of implementation of these factors may differ or be modified from one project to another. Non-functional requirements typically have a more abstract nature and include elements such as performance, reusability, adaptability, dependability, maintainability, security, and portability [42].

Non-functional requirements in this project, following Agile principles, prioritize the over-all quality and performance of the platform. They include:

1) Performance

- The application should load within 2-4 seconds to ensure a smooth user experience.
- Search results for finding skilled workers should return within 3-5 seconds.
- The system needs to be able to handle users accessing it all at the same time.

2) Security

- All user information should be secured with standard encryption methods.

3) Usability

- The web application interface needs to be easy to use and friendly, for all kinds of users including those who aren't technically inclined. It also needs to be responsive, making sure it works properly on other devices and screen sizes.

4) System Reliability

- The application should be running all the time, except for periods where there needs to be maintenance in which case, downtimes are expected.

5) Error Handling

- Error management and clear error notifications must be implemented to avoid user confusion in the event of system malfunctions

6) Code Documentation

- The code of the web application should be well documented and organized neatly for modifications and upkeep of the site.

7) Expandability

- The web application should be able to adapt and grow over time to meet evolving user needs.

8) Connection and Compatibility

- The web application should work smoothly on various browsers e.g. Google Chrome, Firefox, Safari, and Microsoft Edge. Also, services like Google Maps should remain running even when the site is being updated or maintained.

Risk Analysis

1) External Services Challenges: When we rely on tools, like Google Maps there are risks that could affect the functionality of the website and the overall user experience. For example, if Google Maps were to go offline it might disrupt how the map functions within our web application

2) Security Issues: Unauthorized access to personal details, like contact info and location, poses a threat to a person's privacy

3) User Engagement Challenges: Some users who are not technically inclined or are doubtful about the advantages of using the platform to find skilled workers may show reluctance in engaging with the website

4) Operational Challenges: The application might struggle to handle an increase in users or data volume leading to performance issues. Depending on APIs or services such as Google Maps, means that any changes or outages in these services could affect how the application functions

5) Financial Challenge: There is a risk that the revenue models of the application, such, as advertisements may not bring in the expected income, which could impact its long-term viability

Feasibility Study

The feasibility study serves as a method to anticipate the results of an inspection or evaluation of a proposed plan and its potential benefits. These inspections enable examination and assessment of any business concept as well as knowing the necessary prerequisites for initiating the project [44]. The feasibility study is conducted to evaluate if a project is practical and sensible in selecting projects and aiding decision making .

This examination plays a role in assessing the viability of this website from economic, technical and socio-economic perspectives. The main goal of this evaluation is to determine if the website can adequately address the specified requirements, within Nigeria's service industry.

Economic Feasibility

The financial success of a project depends on analyzing its aspects, such, as assessing costs and benefits, evaluating return on investment and conducting break even analysis. This ensures that the project generates revenue than it incurs expenses.

1) Revenue Potential: The web app offers income sources like customized advertising. This type of revenue stream can ensure a flow of earnings. Supporting the long-term sustainability of the project.
2) Cost Efficiency: The operational costs for server hosting, maintenance and ongoing development are expected to be reasonable compared to the revenue.
3) Market Demand: Nigeria has a demand for a platform that simplifies the process of finding and engaging professionals. This demand indicates potential for a large user base essential for the success of the project.
4) Scalability: The technologies selected allow for scalability enabling the application to grow its user base without incurring costs.

Technical Feasibility

The technical feasibility assesses the system's ability to be constructed, by evaluating the potential risks related to users' and analysts' knowledge of the application, familiarity with the technology, project scale, and compatibility with current systems. [45].

1) Technology Stack Selection: The technology stack, for the web application was care-fully chosen to meet its functionality and user experience goals. It comprises of Python and Django for backend development along with HTML, CSS, Bootstrap and JavaScript for the frontend. PostgreSQL is selected to manage the database.
2) Data Availability and Integration: We carefully reviewed all the data sources needed to support a web application. This included checking the availability and reliability of information, user profiles and skill repositories. We also looked into the possibility of using APIs for mapping services to ensure everything runs smoothly and improves user experience.
3) Scalability and Performance: In anticipation of potential expansion and higher utilization of the web application, the technical design has been planned to ensure scalability and performance.

Socio-Economic Feasibility

1) Accessibility and Inclusion: The platform connects skilled workers with clients to improve participation and service availability especially for underserved communities or those in remote areas. This increased access could greatly improve quality of life and access to services.
2) Employment and Skill Development: By creating job opportunities for professionals, the platform can promote job growth which will boost skills development in the local economy.
3) Quality of Life Improvement: Improving access to services can directly enhance people's quality of life by simplifying tasks reducing service acquisition time and ensuring high quality outcomes. It also helps professionals sustain their livelihoods.
4) Environmental Considerations: This study could contribute to sustainability by improving service route efficiency and reducing the need for clients and professionals to travel extensively for services. This could lead to a decrease in carbon emissions.

DESIGN

System Design

During the Design phase specific requirements need to be transformed into specifications that engineers will utilize in the Development phase. These specifications should outline how functional, physical, interface and data requirements will be fulfilled within the system. Typically, this process is carried out iteratively throughout the lifecycle. De-signs may encompass database layouts and user interface blueprints. The Design phase is frequently revisited during development when fresh designs are required due to certain circumstances or modifications to adapt to unforeseen situations [40].

Environment, Programming Languages and Technologies

Development Environment

PyCharm serves as a platform for Python programmers offering tools for code analysis, a debugger, a unit testing feature and compatibility with Django, for web development. Created by JetBrains using IDEA as its foundation [46]. PyCharm serves as the integrated development environment, for our web application. The code editor includes syntax high-lighting, code completion and navigation tools that makes the coding process easier and faster. Moreover, PyCharm integrates with version control systems, like Git to streamline development processes and monitor codebase modifications efficiently.

Programming Languages and Technologies

1) HTML (Hypertext Markup Language) HTML is known as the language of the Internet initially developed for organizing text with meaning but now widely used for creating visual designs. It serves as the backbone of web content and works along-side tools like stylesheets (CSS) and scripts (JavaScript) [47]. The backbone of our web applications visual interface was HTML. It arranges the content and design of the page to improve user interaction. It determined the appearance of forms, footers, images and various elements for users. HTML when paired with tools, like CSS and JavaScript empowers us to integrate content and engaging functions seamlessly.
2) CSS (Cascading Style Sheets) Cascading Style Sheets (CSS) is a technology that plays a role in changing the visual design of HTML content on websites. The W3C developed CSS to separate the appearance from the underlying data structure of HTML or other markup languages. With CSS we could dictate how HTML elements looked and were positioned. It gave us the freedom to personalize aspects such as color, font, spacing and alignment. By utilizing CSS selectors, we ensured consistency in styling across all HTML elements in our website.

3) Bootstrap Bootstrap, a front-end library developed by Twitter in 2011 is renowned for its ability to facilitate website development using HTML, CSS and JavaScript. It provides web developers with a variety of tools and components to create websites. When we designed interfaces for our web application we utilized Bootstrap as a re-source. Its user-friendly features and adaptable grid system helped ease the process of crafting interfaces. Leveraging Bootstraps CSS styles and JavaScript functionalities enabled us to design layouts, menus, forms, buttons and other elements that seamlessly adjust to screen sizes and devices.

4) JavaScript JavaScript, a scripting language first introduced by Netscape Communication Corporation in 1995 is commonly used to integrate interactivity into websites. Its functions include displaying messages, validating content inputs and enhancing user experience through animations and dynamic webpage modifications. In our web application context, JavaScript significantly enhanced performance and user engagement by simplifying API management processes. This improvement enabled us to integrate features such as maps and data loading seamlessly without disrupting user interactions.

5) Django: Django is a web application framework written in Python, which follows the Model View Controller design pattern. Our web application was built on this framework. Django's robust authentication and authorization features help manage users while its URL routing and template engine simplify the process of building web pages. The ORM streamlines database tasks and data modeling by allowing us to define database structures using Python classes and smoothly carry out database operations.

6) Python: Python is an object-oriented, interpreted, interactive programming language with dynamic typing, dynamic binding, and modules. It can also create high-level data structures like lists and dictionaries [48]. Our website was created using Python, a programming language known for its user framework that supports building front-end and back-end features. Python is popular for web development due to its nature making it easy for developers to write and modify code. In our project, Python pro-vided built in functions and a wide range of third-party tools. It managed all aspects of our application from handling data and implementing logic to communicating with the database.

7) PostgreSQL: PostgreSQL serves as the database management system for our web application offering a storage solution for managing data. In our web application, PostgreSQL effectively stores user details, worker profiles, previous work histories, reviews and other important information. Its scalability and performance enhancements guarantee that our application can manage amounts of data and multiple user requests simultaneously without compromising speed or reliability.

8) Google Maps: We increase user engagement by providing mapping tools through the integration of Google Maps onto our website. The Google Maps API allowed us to show maps, provide directions, and allow real-time navigation. Users can find the routes to the locations of skilled workers they want to locate with ease by using Google Maps' route optimization function.

Website Application Architecture

The process of using our website starts with entering information or taking actions like filling out forms looking for employees and sending in requests. Before sending the data to the backend the frontend checks that the user provided details are correct. This includes things like registration info and search terms. When the backend receives the data it applies logic, searches the database for data, does calculations and gives responses. It also works with the file system to save and retrieve media files such as profile pictures. The Figure 5.1 below illustrates this process. After all this is done, the results are sent back to the frontend in a format using HTML, CSS, JavaScript & Bootstrap. Then the Frontend displays these outcomes in a way that ensures an experience, on devices.
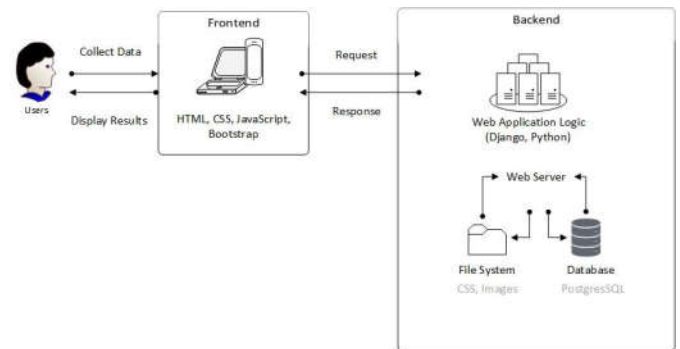

Figure 5.1: Website Application Architecture

User Interface

The user interface serves as the tool that allows users to engage with a product's interface for its services. A user interface represents the interaction between a device and its user through methods or commands for operating the device, inputting data, and accessing content. The concept of user interface extends across various devices including computers, mobile devices, application programs, and content consumption [49]. The designed wireframe for our web application are as follows:

1) Homepage Wireframe: Figure 5.2 shows the mobile and desktop version of the home-page layout which will contain a navigation bar, hero text, and action buttons.

(a) Desktop Version   (b) Mobile Version

Figure 5.2: Homepage

2) Homepage (Active) Wireframe: Figure 5.3 shows the mobile and desktop version of the active homepage layout which will show occupations of workers, search bar, and online status of user.

(a) Desktop Version   (b) Mobile Version

Figure 5.3: Homepage Active

3) Contact Us Wireframe: Figure 5.4 shows the mobile and desktop version of the con-tact page which will contain a box which will include customer service details

(a) Desktop Version   (b) Mobile Version

Figure 5.4: Contact Us

4) Login Wireframe: Figure 5.5 shows the mobile and desktop version of the Login page which will contain Input fields for e-mail, username, password.

(a) Desktop Version   (b) Mobile Version

Figure 5.5: Login

5) Register as Client Wireframe: Figure 5.6 shows the mobile and desktop version of the client registration page which will contain a form for creating a new client account.

(a) Desktop Version   (b) Mobile Version
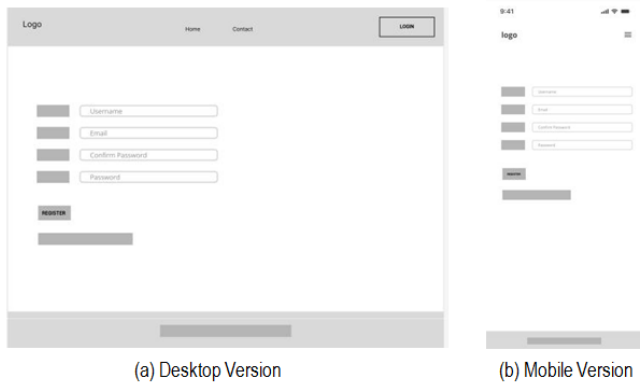
Figure 5.6: Client Registration

6) Register as Worker Wireframe: Figure 5.7 shows the mobile and desktop version of the worker registration page that will contain a form for creating a new worker.

(a) Desktop Version   (b) Mobile Version

Figure 5.7: Worker Registration

7) Search Results Wireframe: Figure 5.8 shows the mobile and desktop version of the search results page which will display search bar, search filters, and worker profiles.

(a) Desktop Version   (b) Mobile Version

Figure 5.8: Search Results

8) Worker Profile Wireframe: Figure 5.9 shows the mobile and desktop version of the worker profile interface that will be for showcasing worker information, skills, and reviews.

(a) Desktop Version   (b) Mobile Version

Figure 5.9: Worker Profile

9) Worker Dashboard Wireframe: Figure 5.10 shows the mobile and desktop version of the worker dashboard interface for updating profile, and checking reviews.

(a) Desktop Version   (b) Mobile Version

Figure 5.10: Worker Dashboard

10) Worker Dashboard (Active) Wireframe: Figure 5.11 shows the mobile and desktop version of the active worker dashboard that will contain dynamic elements used in viewing container blocks.

(a) Desktop Version   (b) Mobile Version

Figure 5.11: Worker Dashboard Active

User Experience / User Interaction Flow

[49] explains User Experience as the interaction and overall experience that involves emotions, thoughts, perceptions, and reactions of users when using an organization's products or services. This includes communication through interfaces and interactions with the aim of evaluating usability. [50] defines user experience as the overall impact experienced by a user when interacting with and using a system, device, or product. This includes the influence of usability, utility, emotional impact during interaction, and recalling the experience afterward. She further explains that "interaction with" includes observing, touching, and mentally engaging with the system or product before any physical interaction takes place. In simple terms, user experience design is a broad concept covering activities aimed at enhancing the user's overall experience.

1) Homepage

- Users arrive on the homepage and are welcomed with an overview of the website's features and options.
- They can explore various sections of the website through navigation links in the header.

2) Registration / Login

- New users have the option to create an account by selecting either the "Register as a client" button in order to find proficient workers and request their services, or the "Register as a worker" button to display their expertise, past projects, and availability for employment.
- Users who are coming back to the website can log into their accounts by entering their login information in the login page.

3) Client Login

- Once logged in, clients will be taken to the homepage where they can explore functions that help them navigate through various job categories or search for particular skilled workers.

4) Worker Dashboard

- When workers log in, they are taken to their dashboard, where they can handle their profile.
- Within the dashboard workers can change their availability status, edit their profiles, view and upload previous work and view ratings and feedback.

5) Search For Workers

- Clients can search for skilled workers based on criteria like location and ratings.
- Clients can use filters to refine their search results and find the worker for their specific needs by utilizing the "sort by" feature.

6) View Worker Profiles

- Clients can check a worker's profile to get information about their skills, back-ground, ratings and past projects.
- Clients can also read feedback and reviews from clients to make informed decisions.

7) Hiring Workers

- Once clients review workers profile, they can contact the worker to discuss job requirements and finalize terms.

8) Review and Ratings

- After completing a task, clients can share feedback and rate the worker based on their experience.

9) Logout

- Users can securely log out of their accounts anytime by clicking on the logout button in the navigation bar.

Use Case

Use case diagrams are utilized to collect the system's requirements, encompassing both internal and external factors. These requirements mainly consist of design specifications. Therefore, when analyzing a system to capture its functionalities, use cases are developed and actors are defined [51]. Following the provided definition, the specific use case diagram for this study can be seen in Figure 5.12.

Use Case Scenarios

1) **Scenario 1:** Client Searching for a Plumber

John, a residential property owner, identifies a dripping tap in his kitchen and promptly requires the services of a plumbing professional. He accesses the online platform and navigates to the main page, where he selects the search option. After inputting "plumber" into the search bar, he initiates the search process and is presented with a roster of local plumbers arranged by proximity. John

evaluates each plumber's profile, considering their credentials, feedback scores, and service availability before
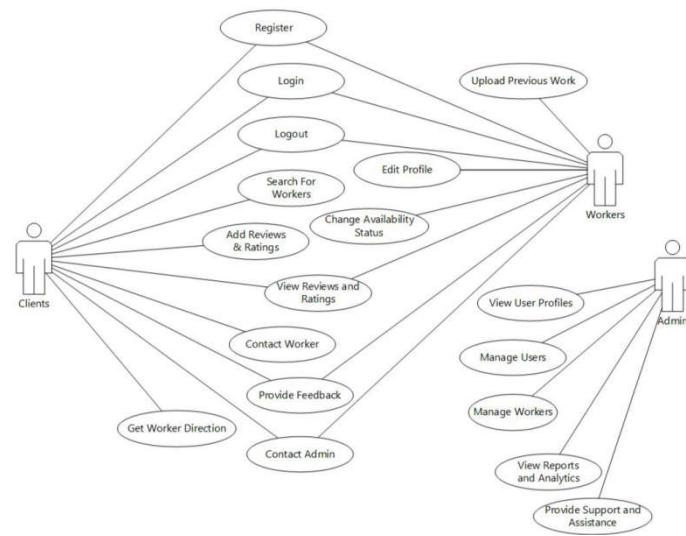

Figure 5.12: Use Case Diagram

opting for one with favorable evaluations. Subsequently, he communicates with the chosen plumber via telephone to arrange a repair appointment.

2) **Scenario 2:** Worker Updating Profile Information

Sarah, a professional in the field of electrical work, has relocated to a different location and is required to revise her profile details on the platform. She accesses her account, navigates to the profile settings section, selects "Edit Profile," and proceeds to modify her latest address, contact details, and range of services provided. Furthermore, she uploads a fresh profile image for customization. Upon verifying the alterations made, Sarah effectively applies them by utilizing the "Save" option. The application verifies that the updates have been saved; thereby enabling potential clients seeking electricians in her vicinity to view Sarah's revised profile information.

3) **Scenario 3:** Client Providing Feedback on Service

Emily, a customer who recently engaged a carpenter through the app, intends to share her assessment of the service she received. She accesses her account and visits the worker's profile, where she evaluates the carpenter's performance using a rating scale from 1 to 5 stars. Additionally, Emily provides an insightful review outlining her overall experience. Following submission of her feedback, the application acknowledges that it has been successfully documented. Subsequently, the carpenter is able to view this appraisal on their profile page.

4) **Scenario 4:** Worker Adding Previous Work

Michael, an expert in roofing, aims to display his past accomplishments on his profile in order to draw in potential customers. He accesses his account and goes to the "Previous Work" section of his profile settings. There, he selects the "Add Previous Work" option and completes a form with information about a recent roofing project he finished. He includes an image of the project as visual proof of his skills. Upon completing the form, Michael's previous work is appended to his profile, enabling clients to view instances of his proficiency in roofing.

5) **Scenario 5:** Client Registering an Account

Emma, who owns a house and needs some help from a plumber is checking out the platform for the first time to find skilled professionals.

Emma clicks on the "Register as a client" button on the homepage where she then gets sent to the registration page. On the registration page, she enters her username, email address and password before selecting to register. After, Emma sets up her account successfully. Now she can log in, make use of all the features tailored for clients on the website and easily find a good plumber that suits her requirements.

Database Design

Our projects database design focuses on storing and managing types of data crucial for our web applications operations. The foundation of our database schema consists of tables that represent entities like users, workers, previous work, reviews and ratings. The database schema and its relationships among these entities are illustrated in Figure 5.13 and Figure 5.14.
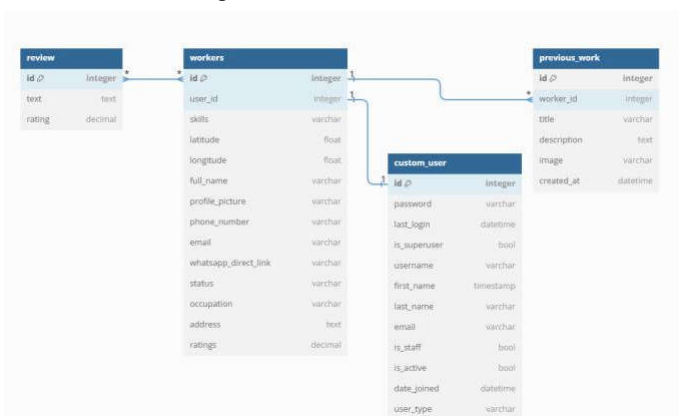

Figure 5.13: Database Schema

Figure 5.14: Database Schema Relationship

The Custom User table, which is based on Django's Abstract User model holds user authentication details such as username, email, password and an additional field indicating the user type (client or worker). This table plays a role in managing users within the system. For workers, the Workers table contains information like skills, location coordinates (latitude and longitude), contact details, occupation, status and reviews. Each worker is linked to an entry in the Custom User table through a relationship to establish a one-to-one connection between users and workers.

The Previous Work table stores information about work previously completed by workers including titles, descriptions, images and timestamps. Each record in this table is associated with a worker through a foreign key relationship to allow workers showcase their skills and experience. Reviews and ratings are stored in the Review

table which includes fields for text feedback and ratings. The table is set up to connect with the Workers table in a many to many relationship enabling workers to receive feedback from various clients.

Entity-Relationship Diagrams (ERDs)

The diagram that illustrates the relationships between elements and their corresponding attributes in our project is called the Entity Relationship (ER) diagram. It focuses on entities like users, workers, previous work and reviews which are components of our sys-tem. Figure 5.15 featured below, shows a clear representation of the relationship between entities of the web application

1) Users: The entity named 'Custom_User' represents both clients and workers. It includes details such as email, password and user type to differentiate between clients and workers.
2) Workers: The 'Workers' entity contains information about workers like their skills, location coordinates (latitude and longitude), contact details, occupation, status and reviews. Each worker is linked to a user through a one to one relationship.
3) Previous Work: The 'Previous_Work' entity stores data about the tasks completed by workers such as titles, descriptions, images and timestamps. Each task is associated with a worker through a one too many relationship.
4) Reviews: The entity called 'Review' records feedback from clients in the form of text and ratings. Multiple reviews can be connected to workers resulting in a many to many relationship, between them.
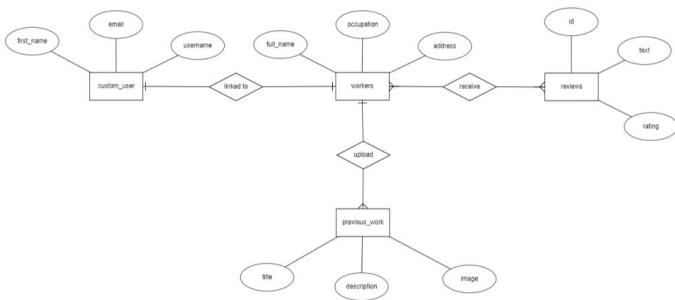
Figure 5.15: Entiy Relationship Diagram

Data Dictionary

A data dictionary comprises explanations of the information stored in our database. It usually provides specific information about each data field, including its name, data type, and descriptions as outlined in Table 5.1, Table 5.2, Table 5.3, Table 5.4.

Table 5.1: Data Dictionary for Custom User Table

Field Name	Data Type	Description	AI	PK	NN	UQ	FK
id	Integer	Primary key	Yes	Yes	Yes	Yes	No
username	String	Unique username	No	No	Yes	Yes	No
password	String	Password	No	No	Yes	No	No
email	String	Email address	No	No	Yes	Yes	No
first_name	String	First name	No	No	Yes	No	No
last_name	String	Last name	No	No	Yes	No	No
user_type	String	Type of user	No	No	Yes	No	No
date_joined	DateTime	Date and time joined	No	No	Yes	No	No

Table 5.2: Data Dictionary for Previous Work Table

Field Name	Data Type	Description	AI	PK	NN	UQ	FK
id	Integer	Primary key	Yes	Yes	Yes	Yes	No
worker_id	Integer	Worker's ID	No	No	Yes	No	Yes
title	String	Title of previous work	No	No	Yes	No	No
description	String	Description of previous work	No	No	Yes	No	No
image	String	Image file path	No	No	Yes	No	No
created_at	DateTime	Date and time created	No	No	Yes	No	No

Table 5.3: Data Dictionary for Workers Table

Field Name	DT	Description	AI	PK	NN	UQ	FK
id	Integer	Primary key	Yes	Yes	Yes	Yes	No
user_id	Integer	User's ID	No	No	Yes	No	Yes
skills	String	Worker's skills	No	No	Yes	No	No
latitude	Float	Worker's latitude	No	No	Yes	No	No
longitude	Float	Worker's longitude	No	No	Yes	No	No
full_name	String	Worker's full name	No	No	Yes	No	No
profile_picture	String	Profile picture file path	No	No	Yes	No	No
phone_number	String	Worker's phone number	No	No	Yes	No	No
email	String	Worker's email	No	No	Yes	No	No
whatsapp_direct_link	String	WhatsApp direct link	No	No	Yes	No	No
occupation	String	Worker's occupation	No	No	Yes	No	No
address	String	Worker's address	No	No	Yes	No	No
ratings	Decimal	Worker's ratings	No	No	Yes	No	No
status	String	Worker's status	No	No	Yes	No	No

Table 5.4: Data Dictionary for Review Table

Field Name	Data Type	Description	AI	PK	NN	UQ	FK
id	Integer	Primary key	Yes	Yes	Yes	Yes	No
text	String	Review text	No	No	Yes	No	No
rating	Decimal	Review rating	No	No	Yes	No	No

Haversine Algorithm:

The Haversine formula is used to determine the distance between two locations on a globe based on their latitude and longitude coordinates. It assists in finding the route over the Earth's surface. This formula has been simplified into an equation that aids in accurate distance computations. This technique is commonly used in solving route optimization challenges. It plays a role in various areas such as artificial intelligence helping improve system efficiency and supporting features like navigation and location-based services [52]. For this web application, we calculate the distance, between two sets of coordinates using the Haversine formula within the haversine function. The function needs four inputs. Lat1, lon1, lat2 and lon2 representing the latitude and longitude values of two points which will

be used for comparing their distance. The formula consists of stages and they include:

1) Because the trigonometric functions in the formula usually operate in radians, the latitude and longitude numbers would be converted from degrees to radians.
2) Find the difference, in longitude and latitude between the two locations.
3) Compute the distance between these points using the Haversine formula, which involves functions such as sine, cosine and arctangent
4) Multiplying the result by the radius of the Earth to obtain the distance in kilometers.

After defining the haversine function it is utilized in the search_workers function to determine the distance between a default location of the user and each workers coordinates stored in the database. This allows sorting workers based on their proximity to the default user location which helps in presenting relevant search results to the user. The haversine forumla is shown in Equation 5.1 below

$$a = \sin^2\left(\frac{\Delta\text{lat}}{2}\right) + \cos(\text{lat}_1) \cdot \cos(\text{lat}_2) \cdot \sin^2\left(\frac{\Delta\text{lon}}{2}\right) \quad (5.1)$$

$$c = 2 \cdot \text{atan2}\left(\sqrt{a}, \sqrt{1-a}\right)$$

distance = R • c

Where:

- lat1 and lat2 are the latitudes of the two points in radians.
- Δlat is the difference between the latitudes of the two points.
- Δlon is the difference between the longitudes of the two points.
- R is the radius of the Earth (mean radius = 6371 kilometers).
- sin is the sine function.
- cos is the cosine function.
- atan2 is the arctangent function with two arguments.

Flowchart

This flowchart which can also be called a sitemap represents the navigation flow for our website. This flow can be seen in Figure 5.16. It begins at the Homepage, the central hub from which users can access various parts of the site. The flowchart descriptions are as follows;

1) Contact Us: A direct link to a page where users can reach out to the customer support team.
2) Register: A section where new users can sign up as either clients or workers, depend-ing on their intent and role.
3) Login: The gateway for existing users to access areas of the site tailored to their roles. Upon logging in, the flowchart depicts a bifurcation point:
4) As Client?: The first decision diamond where the system checks if the logged-in user is a client. If yes, the user is directed to the Search functionality in the homepage, allowing them to query the worker database. This leads to Search Results and sub-sequently to individual Worker Profiles. If no, the flow moves to the next decision point.
5) As Worker?: The second decision diamond which determines if the logged-in user is a worker. If yes, the user is taken to their Dashboard, which provides them with worker-specific functionalities and information. If no, indicating that the user is neither a client nor a worker, the flowchart directs the user to an error message. This message serves as feedback, indicating that the user does not have the necessary per-missions to access the client or worker interfaces due to their undefined user role or wrong login credentials.
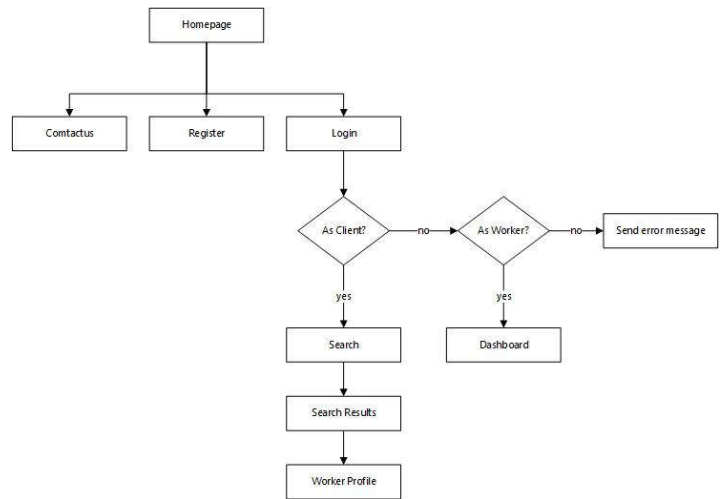
Figure 5.16: Sitemap

IMPLEMENTATION AND TESTING

Implementation

The implementation phase plays a role in the Software Development Life Cycle concentrating on introducing the developed software into an environment where users can now interact with it. In this stage, some important processes are implemented;

1) Careful preparation and coordination are required to ensure a smooth transition from development or test environments to production. This will help the system to be deployed successfully
2) A post-implementation review is then conducted to verify that all requirements have been met and the system functions as expected in the production environment. This review helps to identify any issues that may need to be addressed [40].

This phase plays a role, in creating our web application as it includes releasing the website to its target users and putting it into operation for real world use. The outcome of this phase relies on testing and confirming that the website meets all defined requirements both before and, after implementation.

Deployment of Web Application

Render played a role in the creation of this web application. By integrating with GitHub, we automated the deployment settings ensuring that any updates or modifications in the GitHub repository were automatically applied to our Render environment. The user-friendly dashboard provided by Render allowed us to easily track the status of the web application. Additionally, Render provided services that enhanced the development process of the web application, such as database management and hosting files.

Configuring the Django Web Application for Render

1) Generating Requirements.txt: To operate, Render needs a requirements.txt file that enumerates all the Python packages, for running the application. To generate this file, the command pip freeze > requirements.txt was executed in the Django application terminal.
2) Configuring Allowed_Hosts: To ensure that the web application responds only to re-quests from trusted domains, we updated the ALLOWED_HOSTS setting in the web application's settings.py file. We included the web applications domain, as provided in the Render dashboard to the ALLOWED_HOSTS.

3) Setting Environment Variables: In the "Environment Variables" section of Render's dashboard, the environment variables required were configured for the proper functioning of this application. These variables included specifying the Python version to ensure compatibility and also, the URL of the internal Render PostgreSQL database, allowing the web application to establish connections and interact with the database.

4) Database Configuration: The web application makes use of a database, with the database settings in the web application's settings.py file being set up to use Render's database service. The project is designed to work specifically with PostgreSQL. By offering both internal and external URLs for deployment, Render extends support for this particular database. The internal URL was employed to establish a connection between Render's database service and the web application deployed on render. While the external URL was used to establish a connection between the local environment and the render database.

5) Managing Static Files: To manage static files effectively, White noise was installed into the web application. This package was really helpful in managing files and boosting performance. We made sure to adjust the file settings in the web application to ensure a seamless deployment on Renders platform. Initially we specified the location where static files would be gathered by setting up the STATIC_ROOT setting and defining the directory path. Then we set up the STATIC_URL to establish the base URL for serving files. We also configured the directories that Django would search for files using the STATICFILES_DIRS setting. Lastly, we configured the STATICFILES_STORAGE setting to utilize White Noise's storage system.

Upon successful deployment, this web application was instantly accessible to users across the internet, allowing them to access its features and functionality without any delay. Render's seamless deployment process and reliable infrastructure contributed to a trouble-free deployment experience.

Installed Packages

1) Django:Django is a Python-based web framework that follows the structure of the Model View Template. It gives room for development of applications in quick fashion and places a priority on security with its administration portal [53]. It was used in building the backend infrastructure of this web application. The web application made use of built-in features that were used for routing, templating, and ORM (Object-Relational Mapping).

2) Gunicorn: Gunicorn is a WSGI HTTP server for Python web applications and was used to serve the Django application by ensuring efficient handling of incoming re-quests and optimal performance under high traffic conditions.

3) DJ-database-url: The DJ-database-URL package was used to simplify the configuration of database settings in the Django application. By parsing database connection URLs from environment variables, DJ-database-URL streamlined the process of managing database configurations across different environments.

4) Pillow: Pillow a Python Imaging Library (PIL) fork, was used to handle image pro-cessing tasks within the application. With Pillow, we could easily manipulate images, generate thumbnails, and perform various image-related operations to enhance the functionality of our application.

5) Psycopg: Psycopg is a PostgreSQL adapter for Python it was used to establish connections to the web applications PostgreSQL database from the Django application. Psycopg provided an efficient interface for interacting with the PostgreSQL database by enabling data access.

6) Whitenoise: Whitenoise is a static file serving library for Django which was employed to efficiently serve static files like CSS, JavaScript, and images. By serving static files directly from the Django application, Whitenoise reduced latency and im-proved performance, enhancing the overall user experience.

Modules

1) Homepage: The homepage as shown in Figure 6.1 serves as the landing page for users visiting the website. It includes a welcoming message, along with navigation links to login and buttons to register as a client or as a worker.
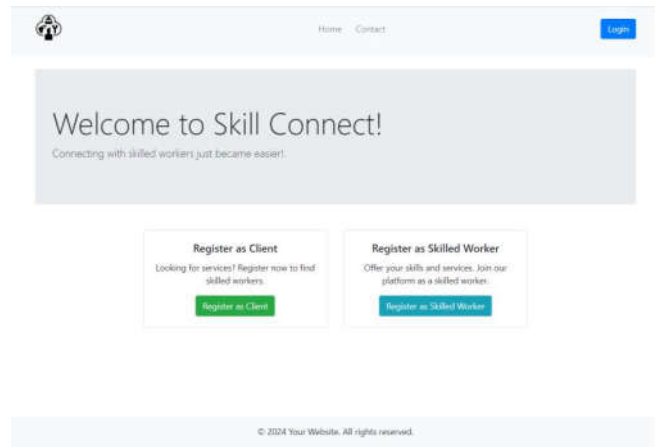

Figure 6.1: Homepage

2) Search Results: This page as shown in Figure 6.2 and Figure 6.3 displays the results of a user's search query for skilled workers. It displays a list of workers matching the search criteria e.g. occupation and then sorted out by location or rating. This page views relevant details of a worker such as their distance, skills, ratings.
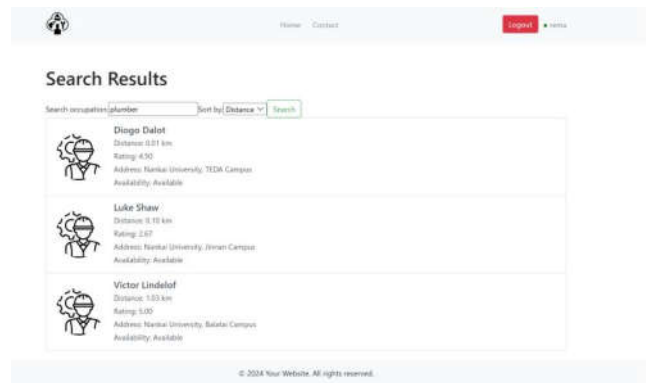

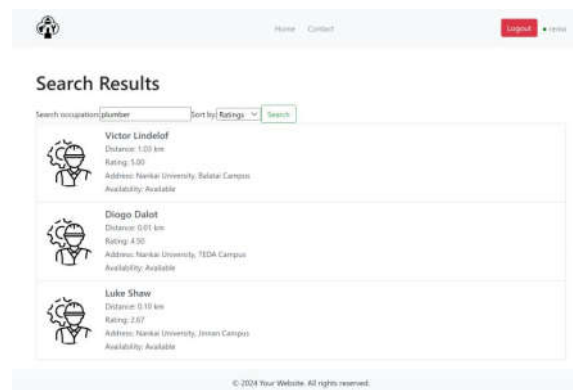**Figure 6.2:** Search Results based on distance

Figure 6.3: Search Results based on rating

3) Worker Profile: Each worker on the platform has a dedicated profile page showcasing their skills, previous work, ratings, and contact information. Users can view detailed information about a specific worker, contact them and decide whether to hire them based on their profile. Users can also leave feedback and rating on the workers profile. Also, users can also get a direction to a worker's location in a situation where they need to go to the workshop. This page can be seen in Figure 6.4.
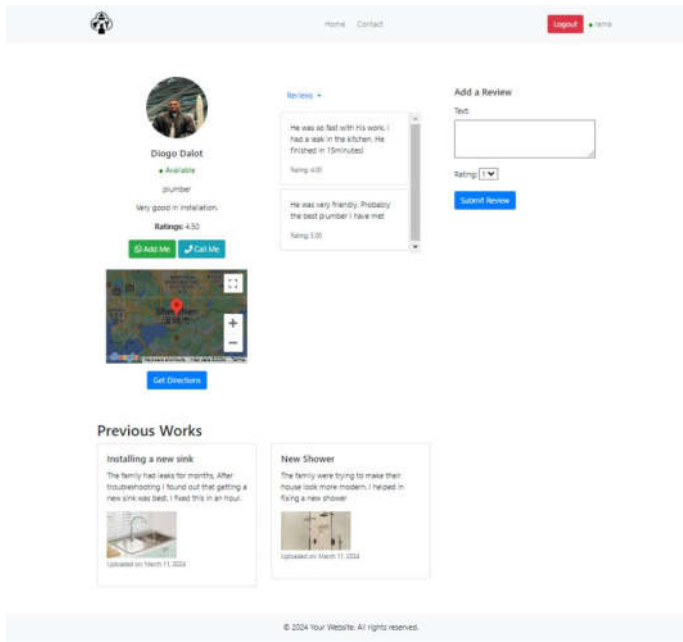

Figure 6.4: Worker Profile Page

4) Worker Dashboard: The worker dashboard in Figure 6.5 is the page where registered workers can manage and edit their profiles by allowing the worker to update profile information, add previous work examples, and monitor their ratings and reviews.
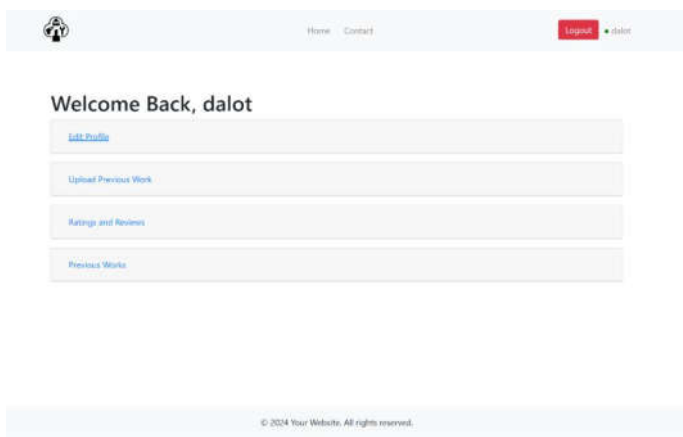
Figure 6.5: Worker Dashboard Page

5) Worker Registration Page: This page as seen in Figure 6.6 allows workers to create a new account on the website by inputting necessary information such as username, full name, email, password, occupation etc.
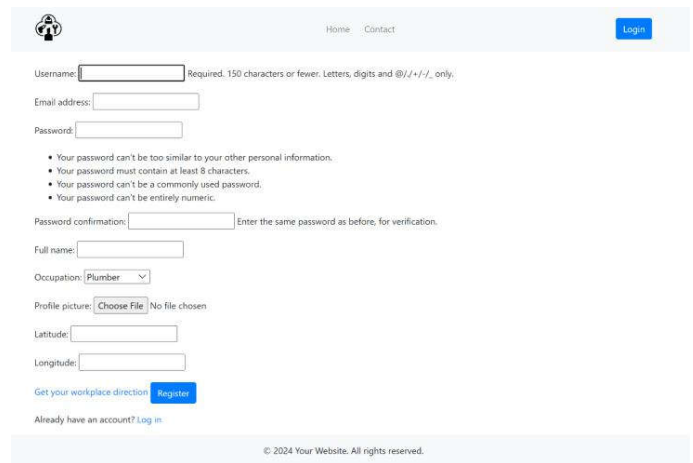
Figure 6.6: Registration Page

6) Client Registration Page: This page allows clients to create a new account on the website by inputting information such as username, email, password. This page is shown in Figure 6.7 below.
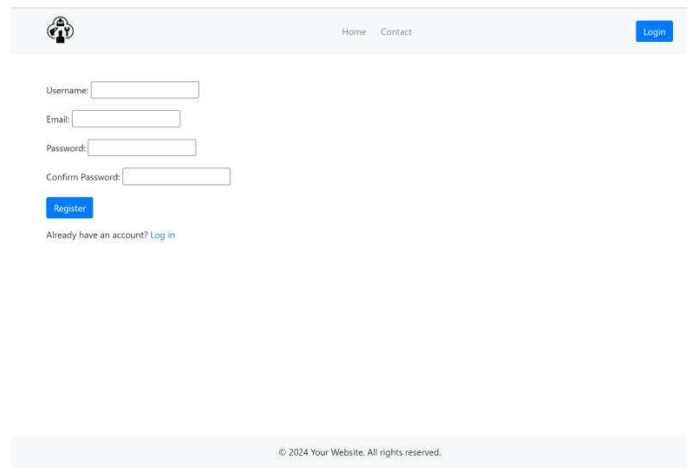
Figure 6.7: Client Registration Page

7) Login Page: The login page as seen in Figure 6.8, enables users to have access to their accounts. Whether they are logging in as a client or as a worker, they can log in using the username and password registered.
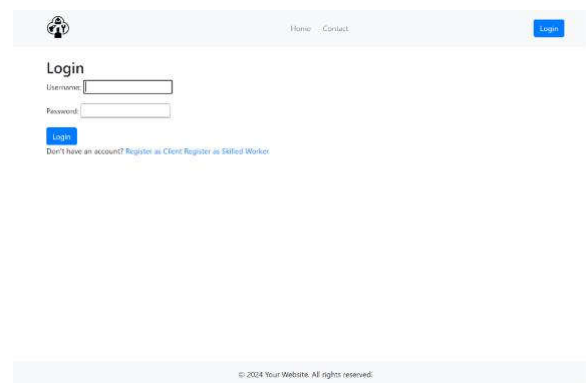
Figure 6.8: Login Page

8) Contact Us: The contact us page in Figure 6.9 allows users who may be facing challenges to reach out to the customer support team.
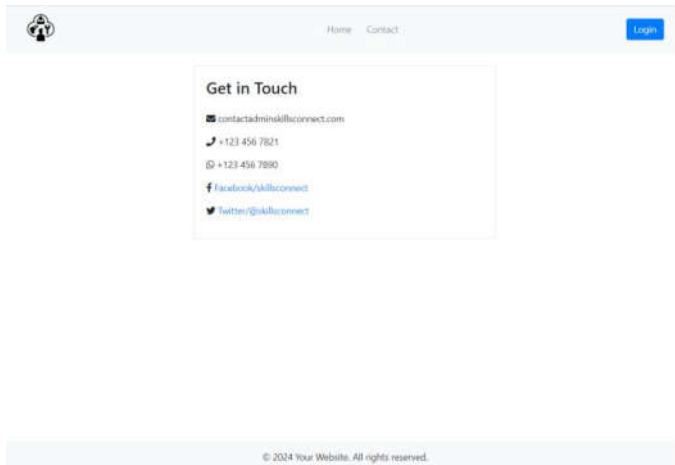
Figure 6.9: Contact Us Page

Testing

The testing phase involves an inquiry conducted to furnish stakeholders with insights into the standard of the product or service being examined. Software testing provides an im-partial and independent assessment of the software. The objective of testing is to guarantee that any flaws are recognized and resolved prior to releasing the product to users [54].

Unit Testing

Unit testing involves isolating and testing individual units of code to ensure they function correctly. This is accomplished by creating unit tests that invoke methods from the class and compare the actual results with the expected outcomes, ensuring each unit meets its design and behaves as intended [55]. Unit testing is a very important process in the implementation of this web application. It helped to make sure that all functions of the application were working properly.

1) Login: For the login function unit testing, we simulated login attempts with correct and incorrect credentials to make sure the system grants access to valid users and also rejecting unauthorized users. This testing can be seen in Figure 6.10 and Figure 6.11.
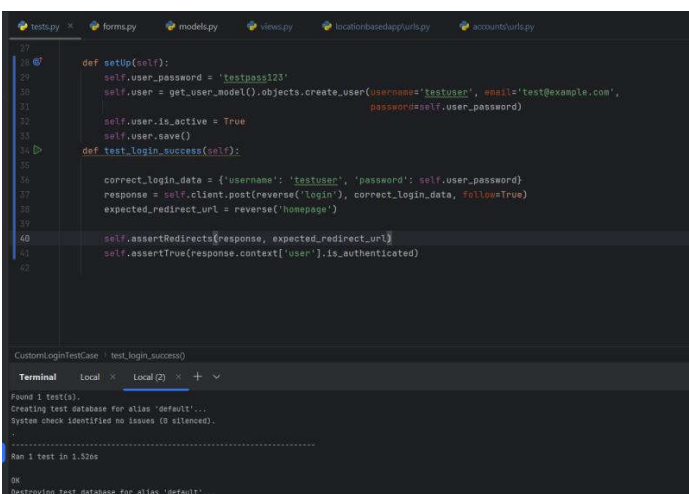
Figure 6.10: Successful Login
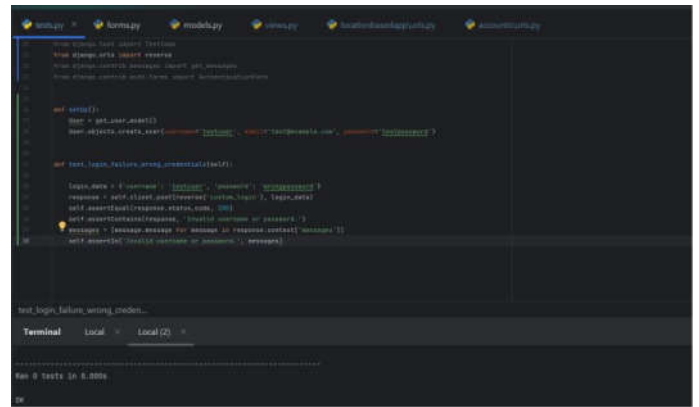
Figure 6.11: Failed Login

2) Client Registration: The unit test for client registration helped prove the application's ability to get client data through the client registration form. This test was successful as shown in Figure 6.12.
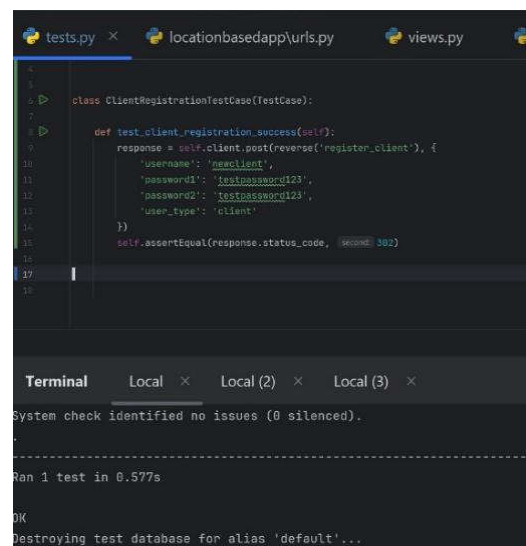
Figure 6.12: Client Registration Test

3) Worker Registration: Unit testing for workers registration was carried out to certify the application's ability to get workers data through the workers registration form. Figure 6.13 shows it was successful.
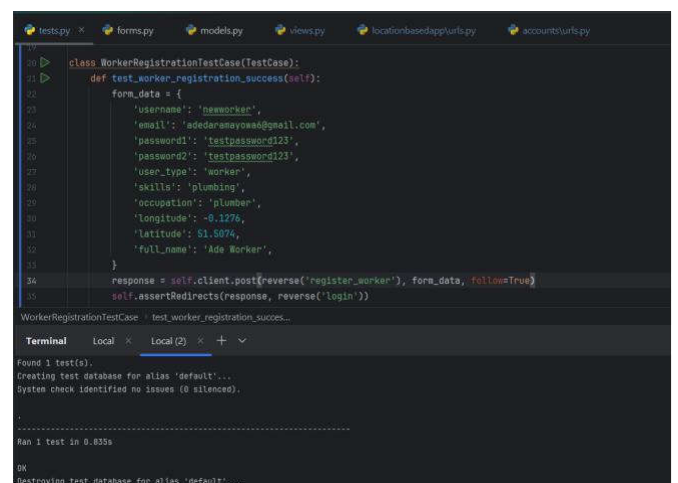

Figure 6.13: Worker Registration Test

4) Search Results: Our search functionality went through unit testing by creating a new worker and then putting in a specific search query, "plumber" which yielded the expected results. This test was passed as shown in Figure 6.14

Figure 6.14: Search Results Test

5) Ratings and Reviews: The Unit test for ratings and reviews ensured that clients can submit ratings and reviews on a worker's profile. This test focuses on verifying the submission of reviews, the accuracy of rating calculations, and the correct display of this information on the worker's profile. As shown in Figure 6.15, it was a successful test.

Figure 6.15: Review and Ratings Test

6) Editing Profile: Profile editing unit testing was conducted to confirm that workers can update their profiles. These tests made sure that all changes are stored and reflect across the application. This test was passed as seen in Figure 6.16

Figure 6.16: Edit Profile Test

Integration Testing

Integration testing involves assessing how groups of interconnected web pages operate collectively. The primary goal of this evaluation is to pinpoint any issues that arise from the combination of these pages [56].

Big Bang Integration Testing

During the testing phase we successfully assessed our web application by employing the Big Bang integration testing strategy. As illustrated in Figure 6.17, this approach enabled us to combine and assess every section of our site simultaneously starting from the Homepage, to the Worker Dashboard guaranteeing operation throughout the platform for all users. This testing was done with the use of test cases and the results are represented in Table 6.1.
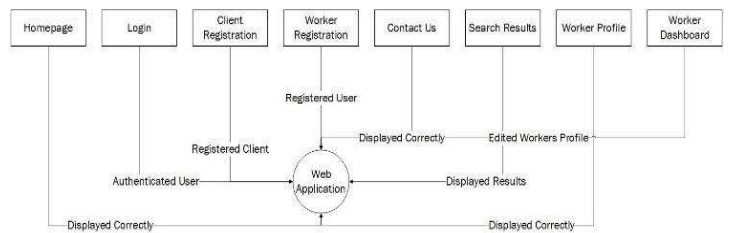

Figure 6.17: Big Bang Test

Table 6.1: Big Bang Test Case Results

ID	Title	Test Case	Expected Results	Status
T1	Homepage	Ensure the homepage loads successfully with no errors.	The homepage renders.	Pass
T2	Login	Attempt to log in with valid credentials.	Successful login redirects to the homepage for a client or worker dashboard for a worker.	Pass
T3	Registration	Register a new client and worker account with all required fields filled.	The new accounts are cre ated, and are redirected to the login page.	Pass
T4	Search & Results	Perform a search using various filters.	Accurate results are re turned that match the search parameters.	Pass
T5	Profile Edit	Update profile informa tion for a worker.	Changes are saved, and the updated profile informa tion is correctly displayed.	Pass
T6	Worker Profile	Verify worker informa tion displays for users and ensure review fea ture works.	The page should load all necessary information of the worker. Also, rat ings and reviews should be functioning properly.	Pass
T7	Contact Us	Verifying Contact Information Displays Correctly	The Contact Us page should load successfully without any errors.	Pass

Functional Testing

This test is crucial, for verifying the functioning of communication, between all servers and the database [57]. It also serves to confirm that errors are appropriately managed and shown to users.

To conduct the interface testing of the website, we followed a structured approach. We defined specific test cases for each key feature and module of the site, such as the homepage, login and registration processes, search functionality, client and worker dashboards, among others as shown in Table 6.2. This process included creating detailed scenarios to test the expected outcome of each module or feature. During the execution phase of this test, we manually navigated through the site and simulated typical user interactions to validate its functionality.

Table 6.2: Functional Testing Results

Test ID	Feature	Test Cases	Steps	Expected Outcome	Status
FT01	Client Registration	Test the client registration process	1. Navigate to registration page. 2. Enter all required details. 3. Submit the form.	Client is registered and redirected to the login page.	Pass
FT02	Worker Registration	Test the worker registration process	1. Navigate to registration page. 2. Enter all required details. 3. Submit the form.	Worker is registered and redirected to the login page.	Pass
FT03	Login Functionality	Test login with valid credentials	1. Navigate to login page. 2. Enter valid username and password. 3. Submit the form.	User is logged in and redirected to the dashboard.	Pass
FT04	Search Functionality	Test searching for workers by skill	1. Enter "Plumber" in the search bar. 2. Press the search button.	List of plumbers based on the user's location is displayed.	Pass
FT05	Review System	Test leaving a review for a worker	1. Navigate to worker profile. 2. Leave a review and rating.	Review and rating are displayed on the worker's profile.	Pass

Test ID	Feature	Test Cases	Steps	Expected Outcome	Status
FT06	Profile Update	Test updating worker profile information	1. Go to worker dashboard. 2. Update information. 3. Save changes.	Worker's profile information is updated.	Pass
FT07	Previous Work Upload	Test uploading previous works	Go to worker dashboard. Upload previous work.	Worker's previous work is updated.	Pass
FT08	Logout Functionality	Test user logout process	1. Click the logout button.	User is logged homepage.	Pass

Performance Testing

This is a very important process for evaluating the efficiency, availability, and overall performance of various types of applications and systems [58]. Performance testing is all about verifying that the web application can sustain heavy loads and still meet performance requirements [57]. For the performance testing of our website, the approach to assess how well our platform handles various levels of demand and stress was focused on. Through this process, we gathered data on load times, response times, error rate, memory usage, database performance and page size as shown in Table 6.3.

Table 6.3: Performance Testing Results

Metric	Load Time	Response Time	Error Rate	Memory Usage	Database Performance	Page Size
Homepage	906ms	738 ms	0%	79MB	n/a	175kb
Homepage (Active)	1.32s	800 ms	0%	74.3MB	n/a	200Kb
Login	985ms	800ms	0.01%	93MB	Ok	175kb
Client Reg	1.3s	900ms	0%	79.6MB	Ok	175kb
Worker Reg	1s	771ms	0%	62.7MB	Ok	176kb
Search Result	1.74s	863ms	0%	81.7MB	Ok	213kb
Worker Profile	2s	457 ms	0.01%	113MB	Ok	500kb
Worker Dashboard	1.46s	700ms	0%	132MB	Ok	124kb
Contact us	1s	803ms	0%	96.1MB	Ok	312kb

Usability Testing

According to [59], Usability can be defined as the level at which a system, product or service can be utilized by designated users to accomplish objectives with effectiveness, efficiency and contentment within a usage scenario. By identifying and addressing usability and acceptance challenges during the early stage of the development phase, it is possible to reduce the required resources, costs and time. Evaluating usability through testing provides insights into how people engage with computers and identify any issues they face with the interface being evaluated. This approach aligns with usability factors like ease of learning, efficiency, error management and overall user satisfaction [60].

After the unit testing, performance testing and functional testing, we went on to gather user feedback on the website. This was done to understand user interaction with our website. we employed a method focused on assessing usability. We assembled 20 respondents, assigning them tasks that necessitated utilizing all website features for both workers and clients. Following this, we distributed a survey to these users to collect feedback, aiming to gauge how both clients and workers navigated and perceived the platform. A sample of the survey is shown below in Figure 6.18 and Figure 6.19.
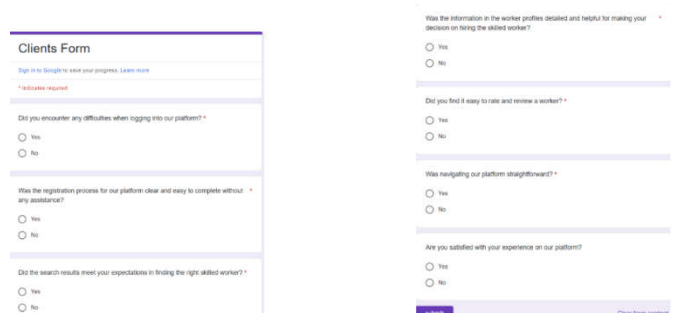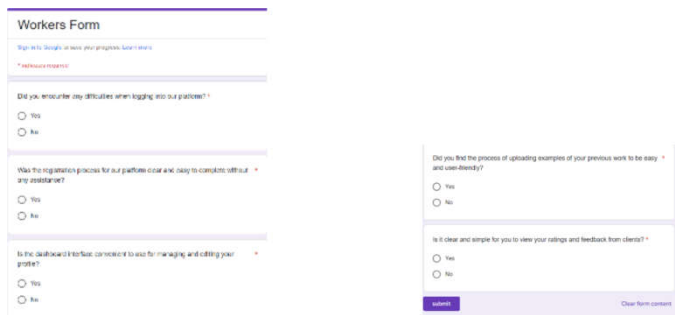

Figure 6.18: Client Survey

Worker ID	Registration	Login	Worker Dashboard	Ratings	Previous Work	Overall Satisfaction
W19	Yes	Yes	Yes	No	Yes	Yes
W20	Yes	Yes	Yes	Yes	No	Yes

Figure 6.19: Worker Survey

The Table 6.4 and Table 6.5 below shows the results to the "Yes or No" questions relating to each feature from the survey. For a visual representation of these findings, refer to the pie chart in the appendix A

Client Feedback:

Table 6.4: Usability Testing Results for Client

User ID	Registration	Login	Search Results	Worker Profile	Review & Ratings	Overall Satisfaction
U1	Yes	Yes	Yes	Yes	Yes	Yes
U2	Yes	Yes	Yes	No	Yes	Yes
U3	Yes	No	Yes	Yes	Yes	Yes
U4	Yes	Yes	No	Yes	Yes	Yes
U5	No	Yes	Yes	No	Yes	No
U6	Yes	Yes	No	Yes	No	Yes
U7	Yes	No	Yes	Yes	Yes	No
U8	Yes	Yes	Yes	No	Yes	Yes
U9	No	Yes	Yes	Yes	Yes	Yes
U10	Yes	Yes	No	Yes	No	Yes
U11	Yes	Yes	Yes	No	Yes	No
U12	Yes	No	Yes	Yes	Yes	Yes
U13	No	Yes	Yes	Yes	Yes	Yes
U14	Yes	Yes	No	No	Yes	No
U15	Yes	Yes	Yes	Yes	Yes	Yes
U16	Yes	Yes	No	Yes	Yes	Yes
U17	Yes	Yes	Yes	Yes	Yes	Yes
U18	Yes	Yes	Yes	Yes	Yes	Yes
U19	Yes	Yes	No	Yes	Yes	Yes
U20	Yes	Yes	Yes	Yes	Yes	Yes

Workers Feedback:

Table 6.5: Usability Testing Results for Workers

Worker ID	Registration	Login	Worker Dashboard	Ratings	Previous Work	Overall Satisfaction
W1	Yes	Yes	Yes	No	Yes	Yes
W2	Yes	Yes	Yes	Yes	Yes	Yes
W3	Yes	No	Yes	Yes	No	No
W4	Yes	Yes	Yes	No	Yes	Yes
W5	Yes	Yes	No	Yes	Yes	Yes
W6	No	No	Yes	Yes	Yes	Yes
W7	Yes	Yes	Yes	Yes	No	No
W8	Yes	Yes	Yes	No	Yes	Yes
W9	No	Yes	No	Yes	No	Yes
W10	Yes	No	Yes	Yes	No	No
W11	Yes	Yes	Yes	Yes	Yes	Yes
W12	Yes	Yes	Yes	No	Yes	Yes
W13	Yes	Yes	Yes	Yes	Yes	Yes
W14	Yes	No	No	Yes	Yes	No
W15	Yes	Yes	No	Yes	Yes	Yes
W16	No	Yes	Yes	Yes	Yes	Yes
W17	Yes	Yes	No	Yes	No	No
W18	Yes	Yes	Yes	Yes	Yes	Yes

CONCLUSION

Conclusion

This study aimed to address a requirement in the labour market by enhancing the connection between users and skilled workers using an online platform. The creation of this website was driven by a gap in the informal sector, where clients and skilled workers often encounter difficulties in finding reliable skilled labor while skilled workers seek broader opportunities to connect with potential clients. By conducting analysis, designing, implementing and testing, this online application has put forward a resolution, to the challenges faced by skilled workers and clients today. The study commenced with an examination of the obstacles encountered by both those seeking services and those providing them shedding light on the inefficiencies of the system. The systems evolution followed Agile methodology. A wireframe was created as a blueprint for designing the web applications user interface. Visual explanations of the web applications functionality were provided through a Use Case Diagram. The database structure was illustrated using an Entity Relationship Diagram, database schema and data dictionary table. Through these development processes it became evident that there were shortcomings in the existing sys-tem. The introduction of the system aims to address these challenges identified. The web application utilized HTML, CSS, Bootstrap and JavaScript as the front end development languages while Python and Django were employed for backend development. The implementation of the haversine algorithm facilitated locating the worker based on both client and worker locations. Integration of Google Maps on the website enhances navigation to workers locations. PostgreSQL was chosen as the database management system for this project. The platform was designed with the requirements of the Nigerian setting in mind incorporating features such as real time location services and user ratings and reviews. To refine the platform and meet the study's objectives. Various tests like unit testing, functional testing, performance testing, usability testing and feedback loops were employed. Interacting with users offered insights that improved the platforms functionality and user experience.

Limitations

This study encountered limitations that are important to acknowledge for a comprehensive understanding of the project's scope and impact. The evaluation phase of the project was relatively short which may lead to not capturing the long-term impact of the web application on the informal sector and user satisfaction fully. This study unknowingly, may have overlooked the needs within the informal sector including varying service requirements, service quality differences and changing skill demands over time. Also, the platforms development relied on a range of user feedback possibly not reflecting the audiences' preferences and needs. This constraint could impact how user centric the platforms design and features are overall.

Future Works

From the development of this web application, it is not to go without mention that there is still room for improvement. A key improvement could be the integration of payment solutions, which will facilitate smoother and more secure bookings via diverse payment methods tailored to Nigeria's market. Another key improvement could be the adaption of recent technology trends like the implementation of artificial intelligence (AI) which can be used to offer personalized service recommendations. Converting the web application into a

mobile application can also be another improvement in this study which is driven by the widespread usage of mobile internet in Nigeria, which will significantly boost accessibility and user engagement. In order to make communication more secure and to avoid contact information of a worker being visible, the introduction of in-app messaging can be another key improvement on the web application.

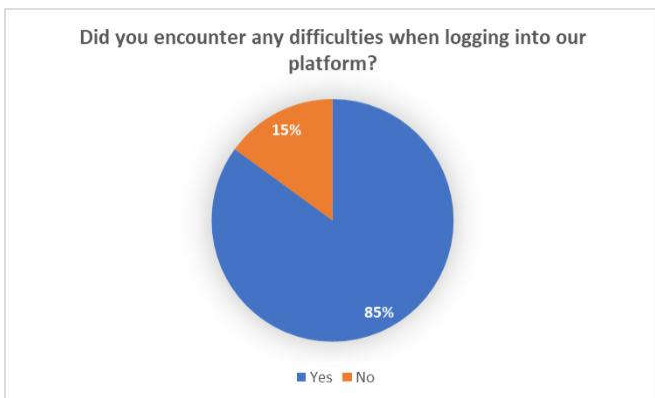# APPENDIX

Appendix A: Usability Testing Outcome

Client Results

1. Login

Figure 7.1: Client Login Survey Result

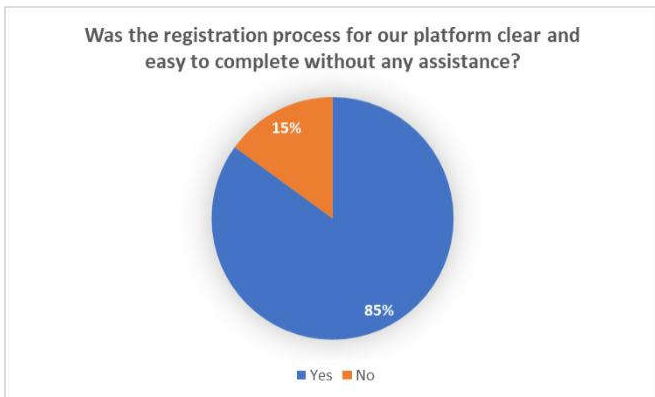### 2. Registration

Figure 7.2: Client Worker Survey Result

3. Search Result

Figure 7.3: Search Results Survey Result

4. Worker Profile

Figure 7.4: Worker Profile Survey Result

5. Review & Ratings

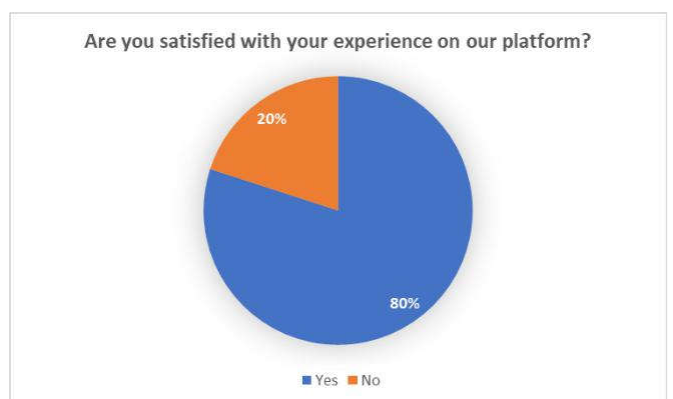**Figure 7.5:** Review and Ratings Survey Result

6. Overall Satisfaction

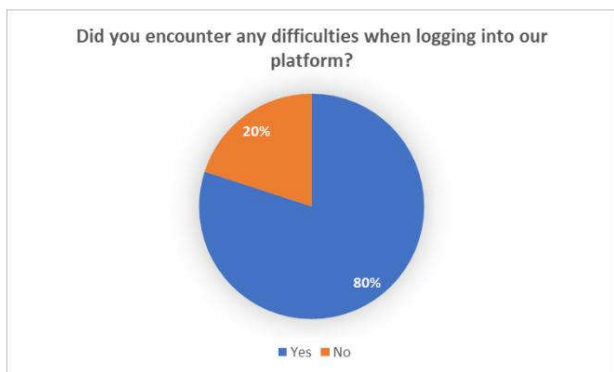**Figure 7.6:** Overall Satisfaction Survey Result

Worker Results

1. Login

Figure 7.7: Worker Login Survey Results

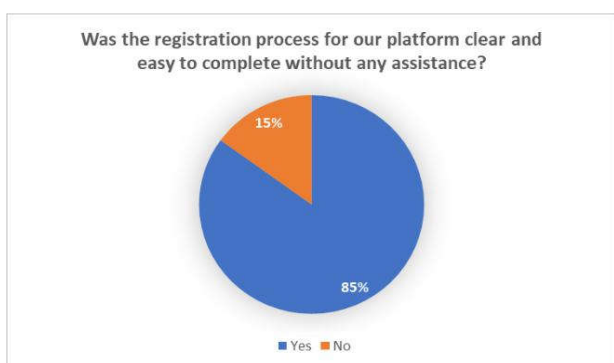### 2. Registration

Figure 7.8: Worker Registration Survey Results

3. Worker Dashboard
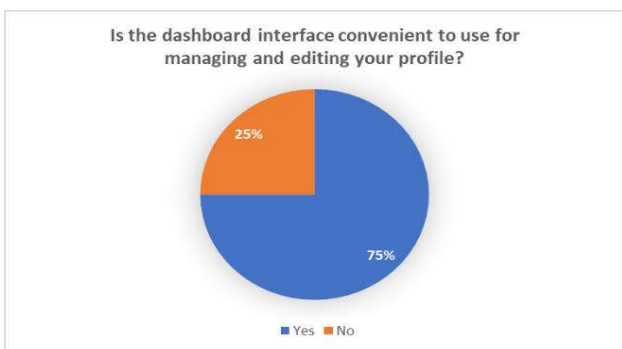

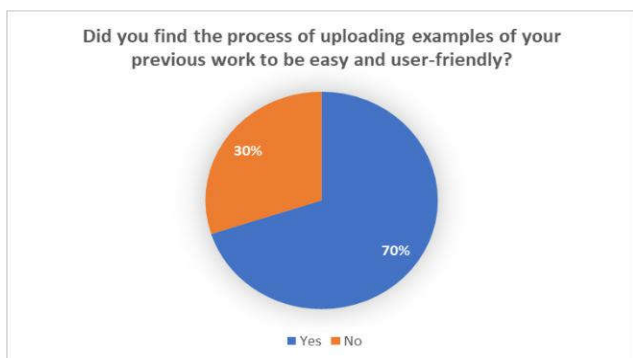**Figure 7.9:** Worker Dashboard Survey Results

4. Ratings

Figure 7.10: Previous Work Survey Results

5. Previous Work

Figure 7.11: Feedback Survey Results Page

6. Overall Satisfaction

Figure 7.12: Overall Satisfaction Survey Results

Appendix B: Code Implementation Screenshots

1. Review and Previous Works Model

```python
class PreviousWork(models.Model):
    worker = models.ForeignKey(Workers, related_name='previous_works'
    , on_delete=models.CASCADE)
    title = models.CharField(max_length=255)
    description = models.TextField()
    image = models.ImageField(upload_to='previous_works/')
    created_at = models.DateTimeField(auto_now_add=True, null=True)
    def __str__(self):
        return self.title

class Review(models.Model):
    text = models.TextField()
    rating = models.DecimalField(max_digits=3, decimal_places=2)
}
```

Figure 7.13: Model for Review and Previous Works

2. Worker Registration Function

```python
def register_worker(request):
    if request.method == "POST":
        form = WorkerRegistrationForm(request.POST, request.FILES)
        if form.is_valid():
            form.save()
            messages.success(request, 'Your account has been created successfully!
                             Please log in.')
            return redirect('login')
        else:
            messages.error(request, 'Please correct the errors below.')
    else:
        form = WorkerRegistrationForm()
    return render(request, 'accounts/register_worker.html', {'form': form})
```

Figure 7.14: Function for Worker Registration

3. Client Registration Function

```python
def register_client(request):
    if request.method == "POST":
        form = ClientRegistrationForm(request.POST)
        if form.is_valid():
            form.save()
            messages.success(request, 'Your account has been created successfully!
                Please log in.')
            return redirect('login')
        else:
            messages.error(request, 'Please correct the errors below.')
    else:
        form = ClientRegistrationForm()
    return render(request, 'accounts/register_client.html', {'form': form})
```

Figure 7.15: Function for Client Registration

4. Haversine Function

```python
def haversine(lat1, lon1, lat2, lon2):
    earth_radius = 6371
    lat1, lon1, lat2, lon2 = map(radians, [lat1, lon1, lat2, lon2])
    dlon = lon2 - lon1
    dlat = lat2 - lat1
    a = sin(dlat/2)**2 + cos(lat1) * cos(lat2) * sin(dlon/2)**2
    c = 2 * atan2(sqrt(a), sqrt(1 - a))
    distance = earth_radius * c
    return distance
```

Figure 7.16: Implementation of Haversine Function

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