Cloud-based Housing Rental Website

CCL Mini Project Report

Submitted in partial fulfilment of the requirements for the degree of
Bachelor of Engineering (Computer Engineering)

Third Year Computer Engineering

By

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(2021-22)

Terna Engineering College

Nerul, Navi Mumbai

Academic Year 2021-22

CERTIFICATE

This is to certify that the CCL Mini Project entitled "Cloud-based Housing Rental Website" is a bonafide work of

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submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the Bachelor of Engineering (Computer Engineering).

Guide **Head of Department** **Principal**

Approval Sheet

Project Report Approval

This Mini Project Report - entitled “Cloud-based Housing Rental Website” by the following students is approved for the degree of B.E. in "Computer Engineering".

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Examiner’s name and signature:

1. _

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Date: _

Place: _

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Kaustubh Hemant Patil	ID No. TU3F1920126	_ _ _ _ _ _ _ _
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Acknowledgement

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We take the privilege to express our sincere thanks to Dr. L. K. Ragha, our principal for providing the encouragement and much support throughout our work.

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Abstract

Computer Engineering is a field that integrates hardware and software design. The branch focuses on not only the study of the working of computer systems, but also brings light to the role they play in the big picture. This can be seen in its various applications, from the design of microprocessors to software development. In the 21st century, the Computer Engineering industry is one of the forefronts for technological innovation.

Mini Projects emphasize on innovation and entrepreneurship through software development. It involves questioning different areas of the field of study - What innovations can we introduce? How can we improve existing models? We are motivated to identify our own methodologies and practice project management principles such as researching different domains, validation and verification of data, and documenting the project through technical report writing. With this in mind, we proceed with project-based learning.

Cloud Computing itself is an epitome of how innovations in Computer Engineering are empowering applications through the cloud. What began as an act of outsourcing the hosting and maintenance of servers has now evolved into much more than that, thanks to leading tech companies like Amazon, Google, and Microsoft. Today’s servers can be programmed to not only host applications from almost anywhere across the globe, but can also run multiple custom-built services such as virtual machines & virtual servers, real-time monitoring, flexible storage, etc. Users today can avail from over 490 such services from AWS, Google Cloud, or Microsoft Azure alone.

Cloud Computing services are not only efficient, but affordable and easy to use with flexible plans and pay-as-you-go pricing, making them one of the most popular domains in the field today. The assigned mini project is an opportunity to explore the scope of cloud computing services for the development a cloud application - internet-run program with components stored online with some (or all) processes executed in the cloud and implement the same.

Figures

1. Introduction

1.1. An introduction to the residential rental market

In our earliest years of education, we learn the basic needs of man - food, water, shelter, and clothing. Of course, with evolution & technology, our needs have evolved, and multiple necessities have added to the list.

Consider housing. In 2019, India's residential rental market was worth more than USD 20 billion, of which 68% or USD 13.5 billion is in urban areas. Urbanization - the population shift from rural to urban areas - has increased the demand for housing in not only terms of quantity, but quality of living as well which makes perfect sense when considering the way civilizations have advanced.

Today's customers are encouraged to be more aware and mindful of details when it comes to housing. To create more incentives, advertisers must ensure that the property listings they advertise include essential details such as the price, location, photos, amenities, etc. on demand at any time - in other words, there's a need to make a wider spectrum of data available to customers.

This suggests the scope for a systematic approach towards the sector. A platform where owners can advertise their properties and thus make a customer's experience seamless. Besides the traditional objects we can create on a website, cloud computing services can empower such an application by allowing us to store, manage, and retrieve rental posts.

This report illustrates the process of creating such a project over the following chapters.

1.2. Organization of Report

Chapter 1 has been a short introduction to the field and what the project involves.

Chapter 2 illustrates the research conducted on the history of the domain and previous solutions as well as a short analysis of existing technologies, building up to framing the problem statement of the project.

Chapter 3 discusses the problem statement further and highlights the aim of the project as well as the objective-based approach taken to solve the problem.

Chapter 4 is a brief overview of the design, including the system's architecture and infrastructure.

Chapter 5 displays the results of the project, including the screenshots of what has been implemented as well as a short illustration of the project's functioning.

Chapter 6 concludes the report, discussing the takeaways from the project and future scope.

2. Literature Survey

Renting, also known as hiring or letting, is an agreement where a payment is made for the temporary use of a good, service or property owned by another. The act of renting accommodation, however, developed from a more primitive form of tenancy, called tenant farming which dominated prehistoric and ancient social relationships.

For instance, a major portion of the population were slaves to the pharaohs of ancient Egypt. In exchange for their worship through acts of labor for construction of the pyramids, he would provide them with some sort of food and shelter. By the time of the Romans, social attitudes had developed somewhat, so that even though there was an Emperor, who could force anyone to do anything with a word, the system of landowning and tenancy had evolved to something closer to the system we have today. By then it was accepted convention that legitimate Roman citizens should have some right to property, even if they could not own land. Here renting began in earnest, with plebians - the Roman term for the common poor–renting living space, usually at exorbitant rates, renting from their wealthier counterparts. While this system perpetuated the gap in wealth between the two classes, it at least provided a strong classical precedent for poorer classes to live as tenants.

That all began to change in England in the late fifteenth century, when an increase in trade among other things precipitated the rise of a healthy middle class. This began to give the lower classes more purchasing power for meeting their needs - including housing. Thus renting - and the entire economy - was stimulated by the ideology of freedom of property which was built up over generations of civilization.

Capitalism, and the rise of the middle class, helped blur the once-clear line between rich and poor, and an increasing number of people began to rent under better conditions and with better interest rates. People of similar means began renting to each other, as equals. The resulting growth of the economy from this more efficient and fair method of business only increased people’s commitment to making the business of renting and tenancy more manageable.

Fast forward to today, and the housing rental market is booming.

Rental solutions have been key to addressing India’s housing challenges, and the country’s rental real estate holds immense potential. In 2017, the rental real estate market was pegged at one crore units and was valued at $22 billion (Rs 1.53 lakh crore). In 2019, India's residential rental market was worth more than USD 20 billion, of which 68% or USD 13.5 billion is in urban areas. By 2023, its volume is expected to be 1.8 crore and valuation $41 billion (Rs 2.85 lakh crore).

Urbanization - the population shift from rural to urban areas - has increased the demand for housing in not only terms of quantity, but quality of living as well which makes perfect sense when considering the way civilizations have advanced.

Today’s customers are encouraged to be more aware and mindful of details when it comes to housing. To create more incentives, advertisers must ensure that the properties they advertise include essential details such as the price, location, photos, amenities, etc. on demand at any time - in other words, there’s a need to make a wider spectrum of data available to customers.

This suggests the scope for a systematic approach towards the sector, and this is what recent solutions have offered, including sites such as *99acres* since 2005 and *Magicbricks* between 2011 and 2014. However, creating accounts for the sake of registering on platforms can cost an initial fee in the long term with most sites only allowing one free listing - not to mention the advertisements breaking what should otherwise be a seamless user experience.

3. Problem Statement

3.1. Problem Statement

Having conducted a survey of existing literature and solutions, it is safe to conclude that while applications do exist in the given domain, there also exists scope to integrate more cloud-based services into a more simplified application. Hence, based on the drawbacks discussed in the previous chapter, we can summarize the problem statement of the project as:

The housing rental market is a vast emerging sector, and modern demands require a more simplified, sophisticated system that can provide basic customer needs on-demand.

3.2. Aim & Objectives

The main aim of the project is to develop a simple cloud-based application, i.e., an internet-run program with components stored online with some (or all) processes executed in the cloud.

Thus, the project is not limited to running workloads remotely over the internet in a commercial provider's data center, but also incorporating multiple cloud services to empower the application. We aim to deliver a project that demonstrates cloud computing deployment, utilization, and monitoring.

To meet this aim and tackle the problem, the objectives we laid out for our project are:

- Design and implement a web application that enables a user to browse and upload places for rent through the cloud.
- Deploy the website as a cloud application.
- Ensure a smooth, simple user interface.

4. Design

4.1. System Requirements

4.1.1. Hardware Requirements

At least 4GB of RAM and an i5 processor is required.

4.1.2. Software Requirements

The system can be used on different operating systems including Windows, macOS, and Ubuntu as long as it supports web browsing.

4.2. System Architecture

When it came to the design, we were prompted to first layout the architecture of the proposed system. This involved listing out the tools used and forming a blueprint as per our requirements. They are listed as follows:

Interface	HTML, CSS, ReactJS
Cloud Services	Google Firebase, AWS S3

HTML is the markup language that we use to structure and give meaning to our web content, for example defining paragraphs, headings, and data tables, or embedding images and videos in the page.

CSS is a language of style rules that we use to apply styling to our HTML content, for example setting background colors and fonts, and laying out our content in multiple columns.

JavaScript is a scripting language that enables you to create dynamically updating content, control multimedia, animate images, and pretty much everything else.

An analogy you can use for understanding a website is automobile manufacturing. Like web development, manufacturing automobiles is divided into parts: building the car's body frame, installing the engine, and finally the body paint + interior components. Web development works in a similar fashion if you substitute the tasks as follows:

HTML ⇨ Building the website's "body frame"
JavaScript ⇨ Installing the website's "engine"
CSS ⇨ Giving the website a "paint job".

They work together to provide a simple yet effective user interface for the visitor to engage with.

As for the cloud-based technologies, we've used Google Firebase - a real time No-SQL database to manage the application users' data using a ready-made API. We have also used AWS S3 – a simple storage service that provides object storage through a web service interface.

Both use scalable storage infrastructure, which means no excess cloud services will be in use once the application is deployed. Using these cloud services, we can organize and manage our data in ways that support specific use cases, enable cost efficiencies, enforce security, and meet compliance requirements.

4.3. System Infrastructure

Although cloud services can be included in an application's architecture to empower it, they are eventually just tools we use to construct the application. What makes a difference when it comes to the final product is how we use and implement them - which is precisely what infrastructure is all about.

HTML, CSS, and JavaScript come together to form the client-side dynamic interface. However, ReactJS has been used to integrate Firebase with the website. This required us to install the SDK (Software Development Kit) on the device and import various Firebase scripts into the project workspace.

Google Firebase has primarily been used in the project to implement a more secure cloud-based authentication system for users of the application. The console displays the data provided by users in multiple views, including a unique user UID. It has been similarly able to store the details of listings.

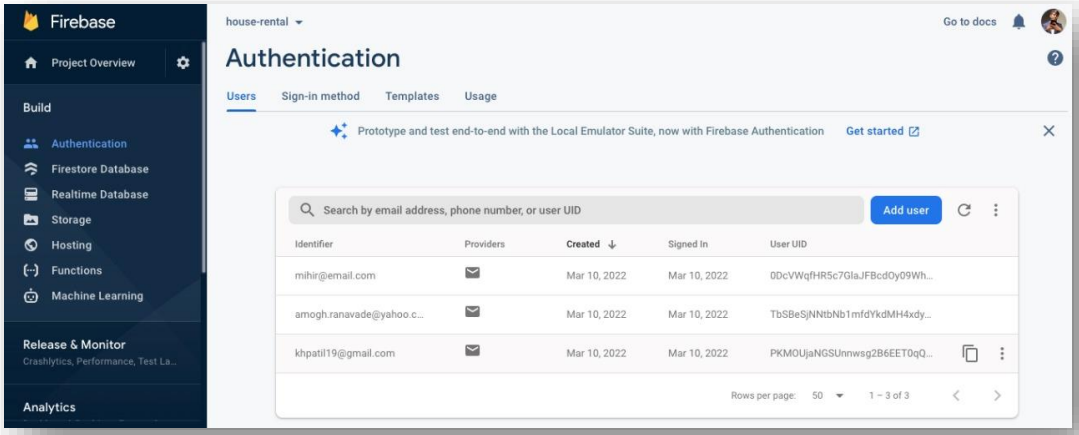

Fig. 4.3.1. Google Firebase Console: Authentication

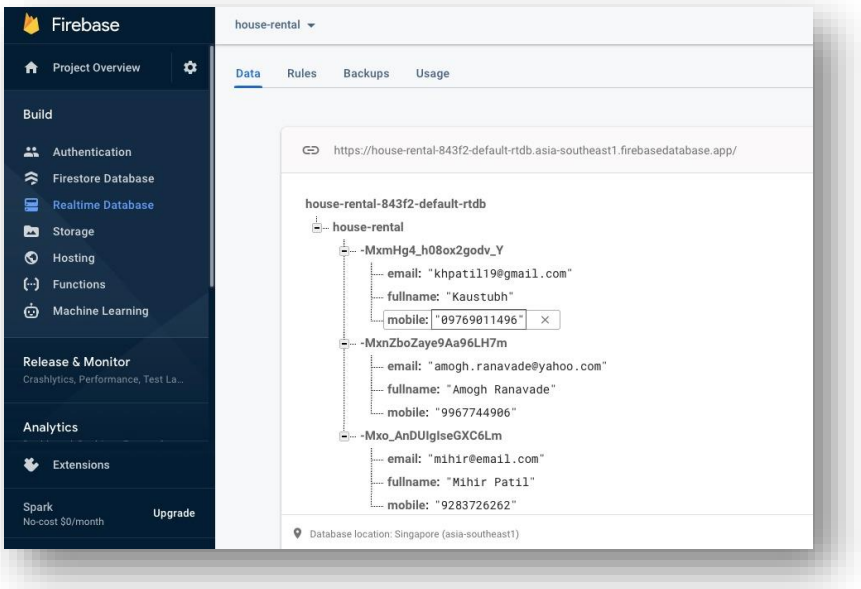

Fig. 4.3.2. Google Firebase Console: Realtime Database

The advantage of using Google firebase has been that there are no queries needed to run, which means we can easily manage the user base.

As for hosting the website on the cloud, we have used AWS S3.

5. Results & Implementation

5.1. Project Screenshots

The screenshots of the project implementation are given below:

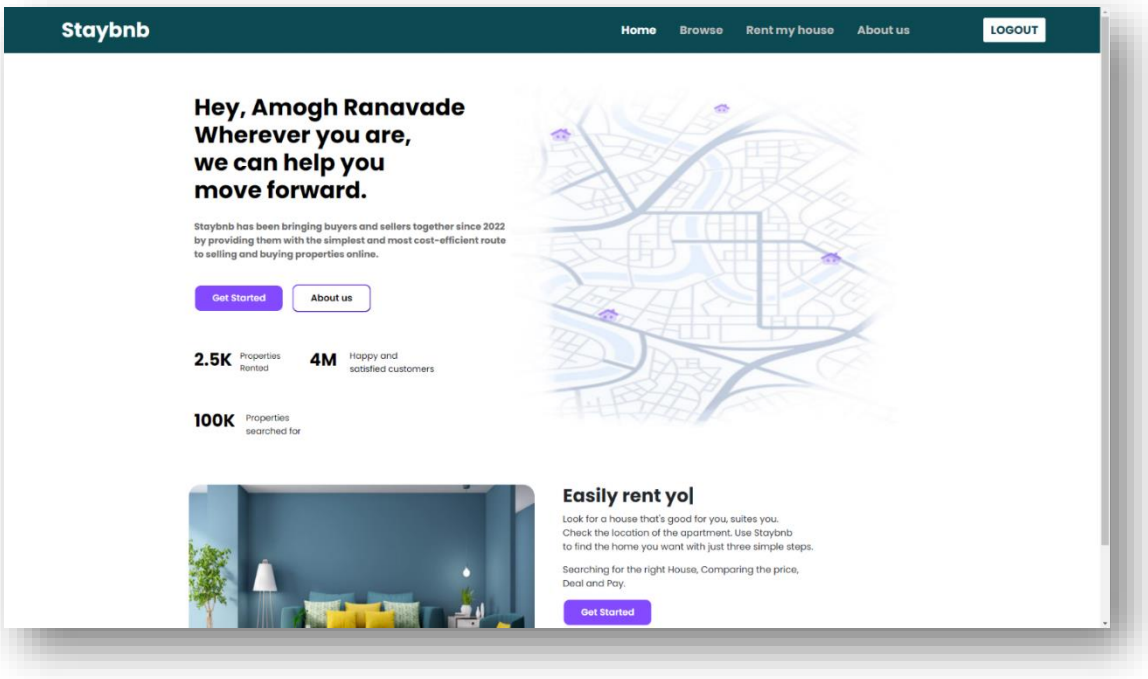

Fig. 5.1.1. Home

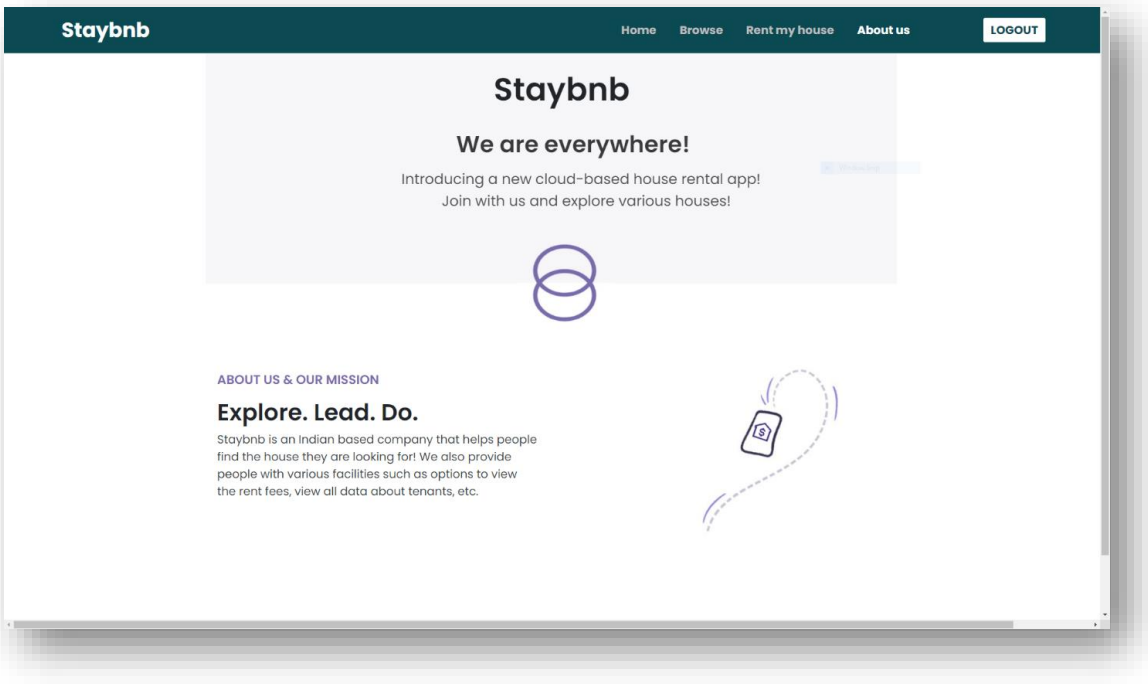

Fig. 5.1.2. About

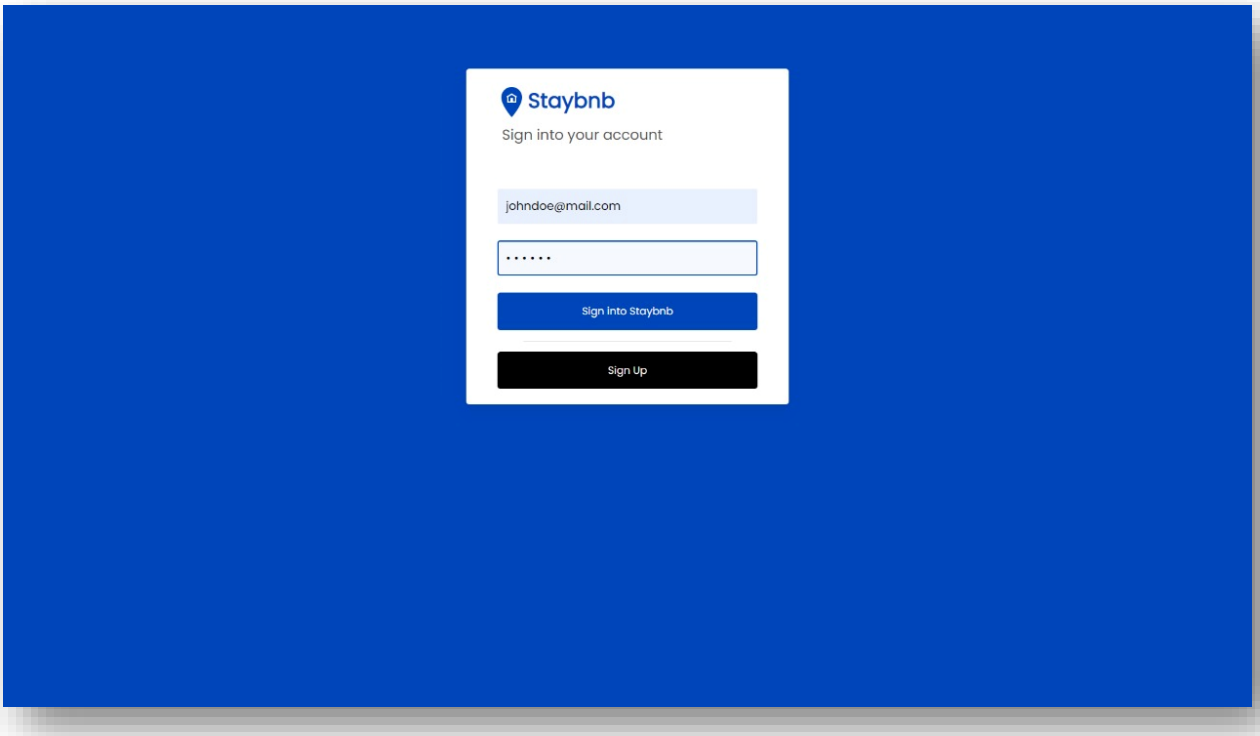

Fig. 5.1.3. Login

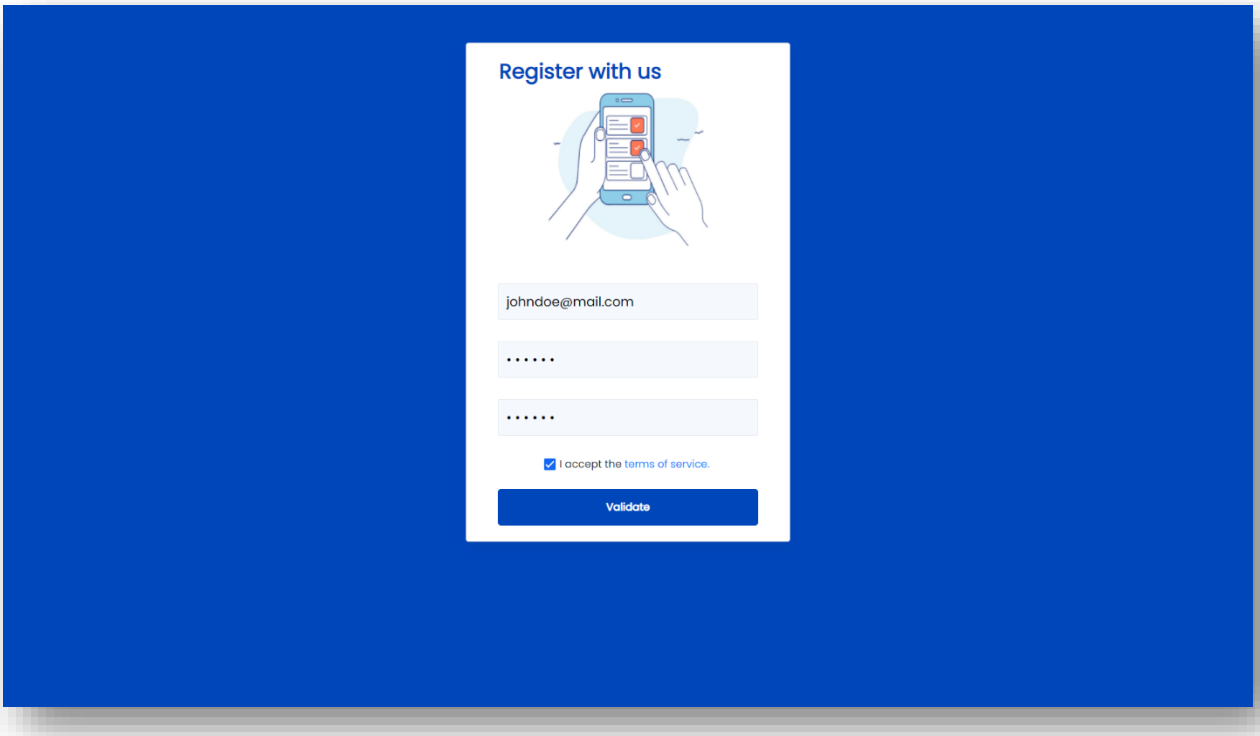

Fig. 5.1.4. Registration (Part 1)

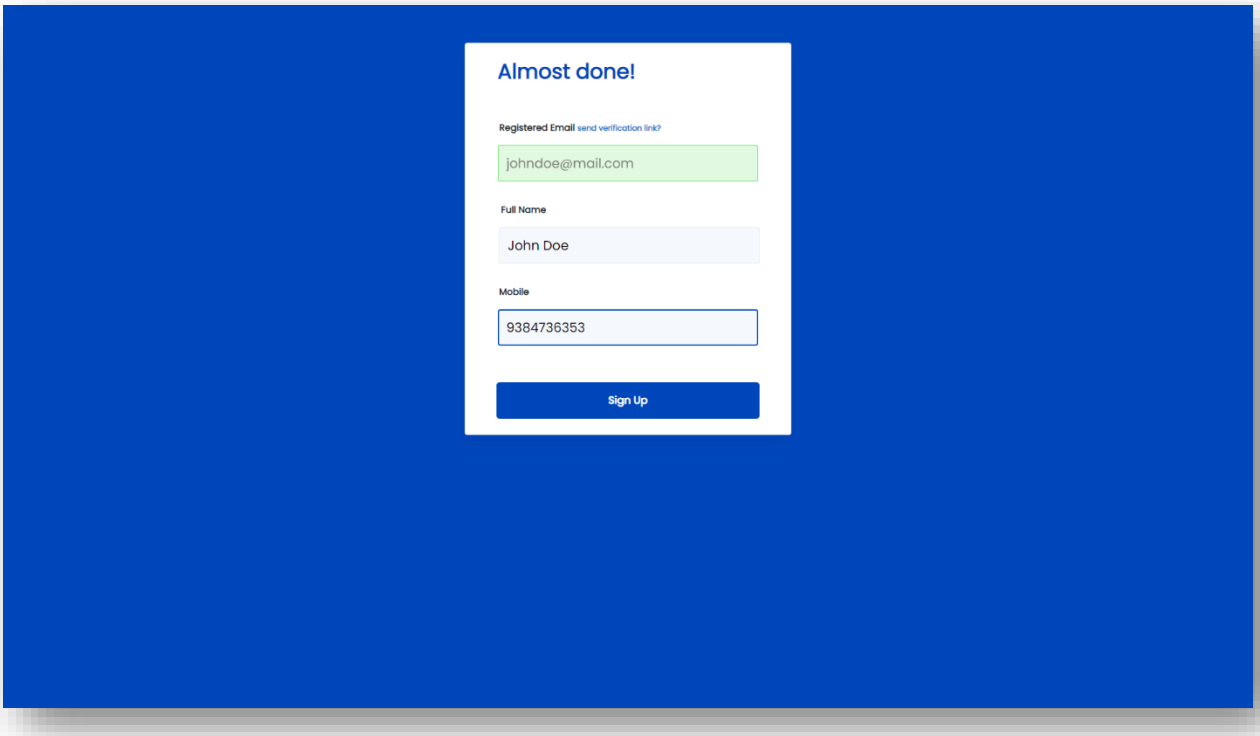

Fig. 5.1.5. Registration (Part 2)

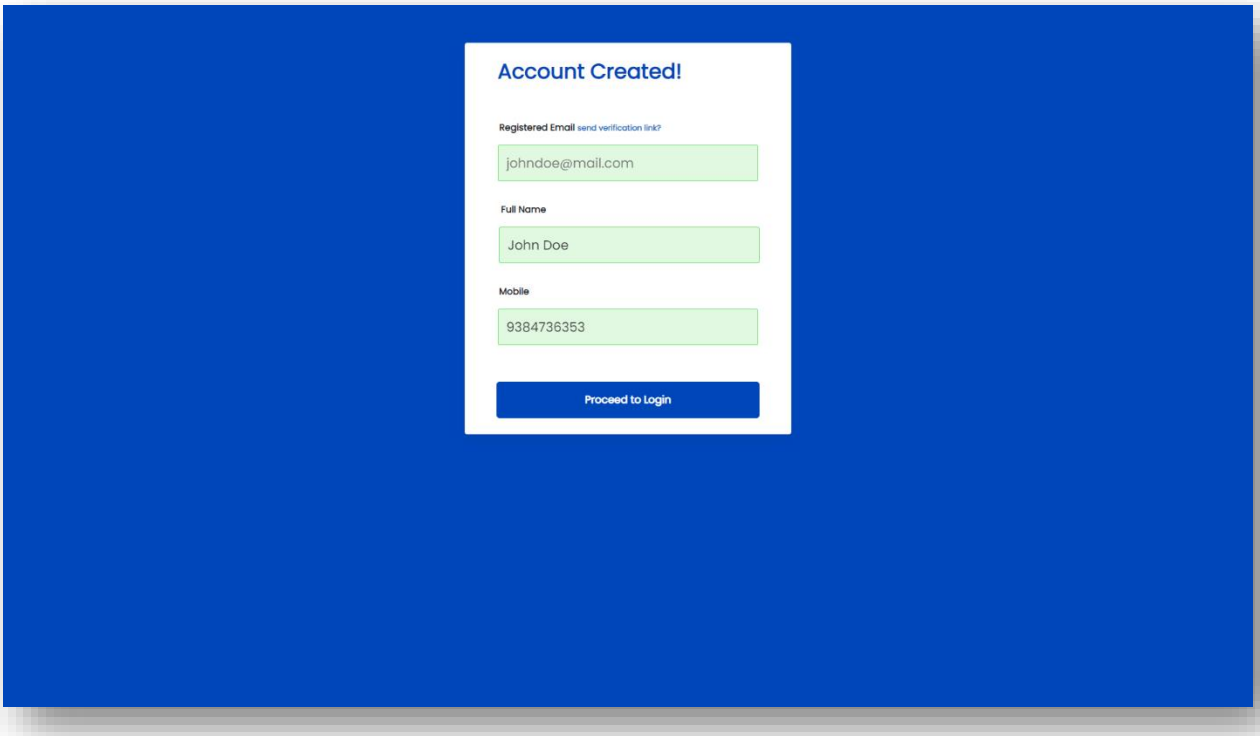

Fig. 5.1.6. Account creation successful

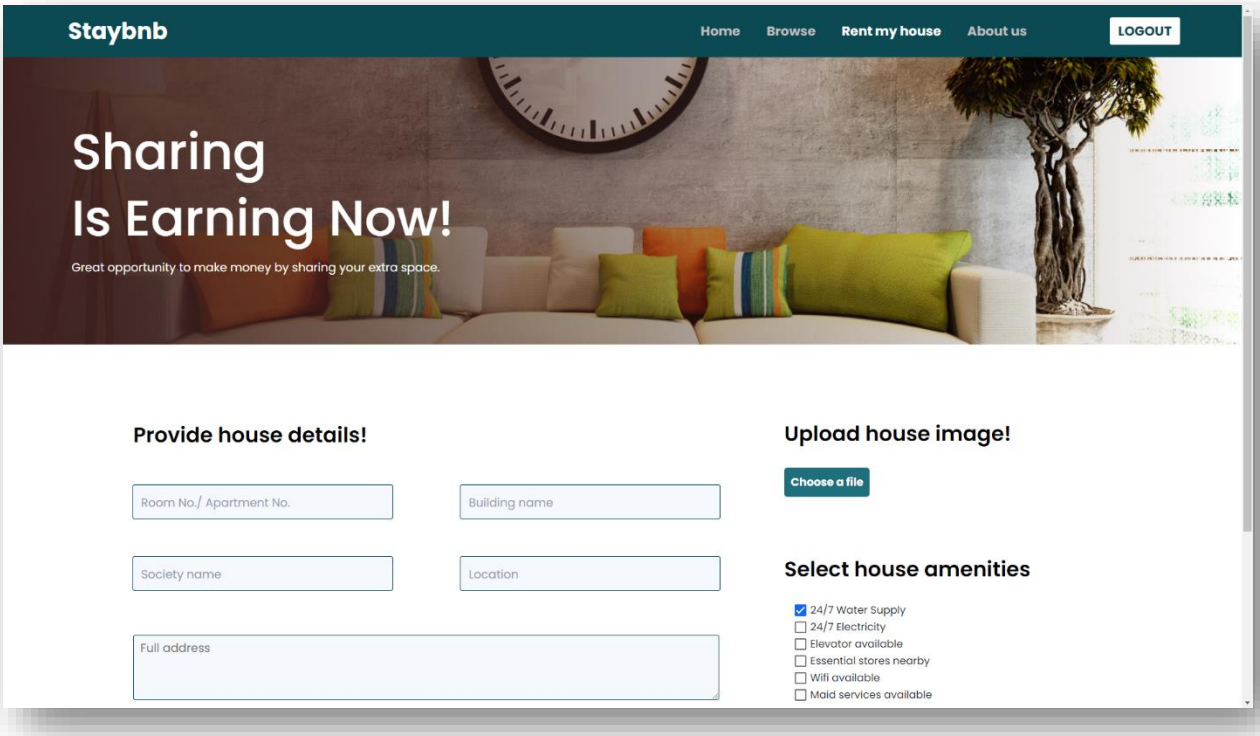

Fig. 5.1.7. Rent (Top)

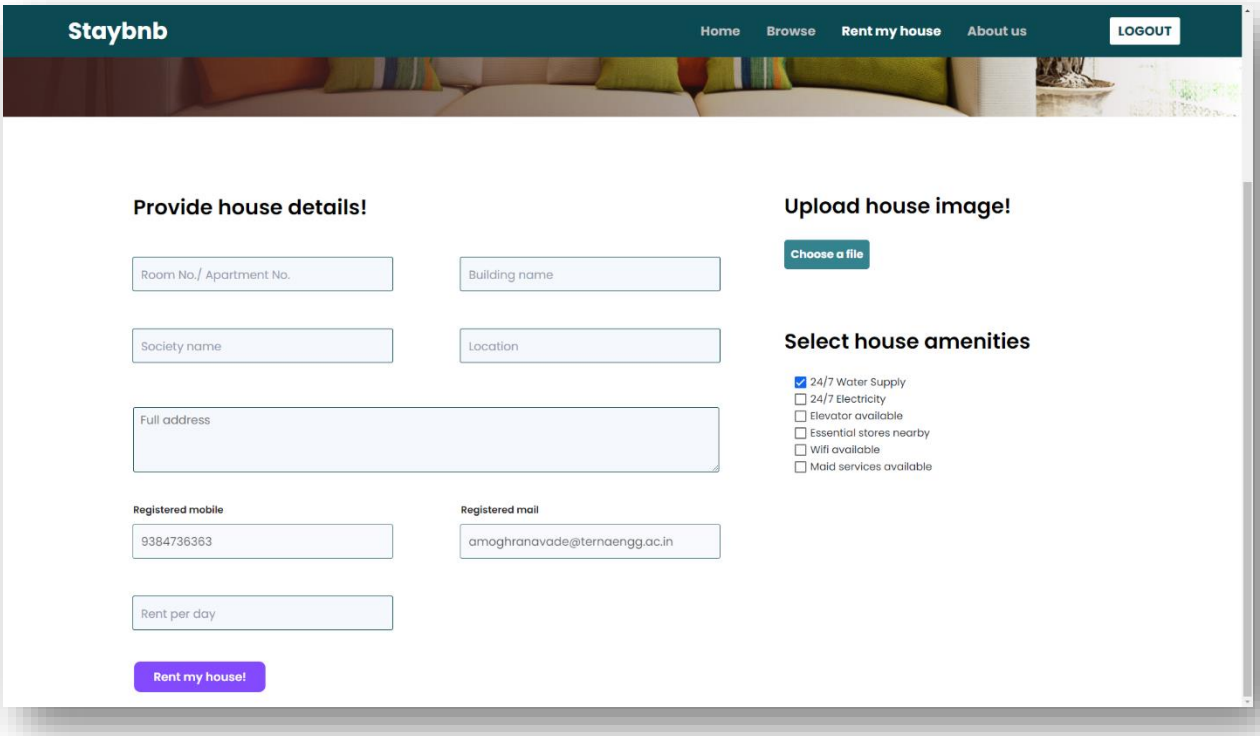

Fig 5.1.8. Rent (Scroll)

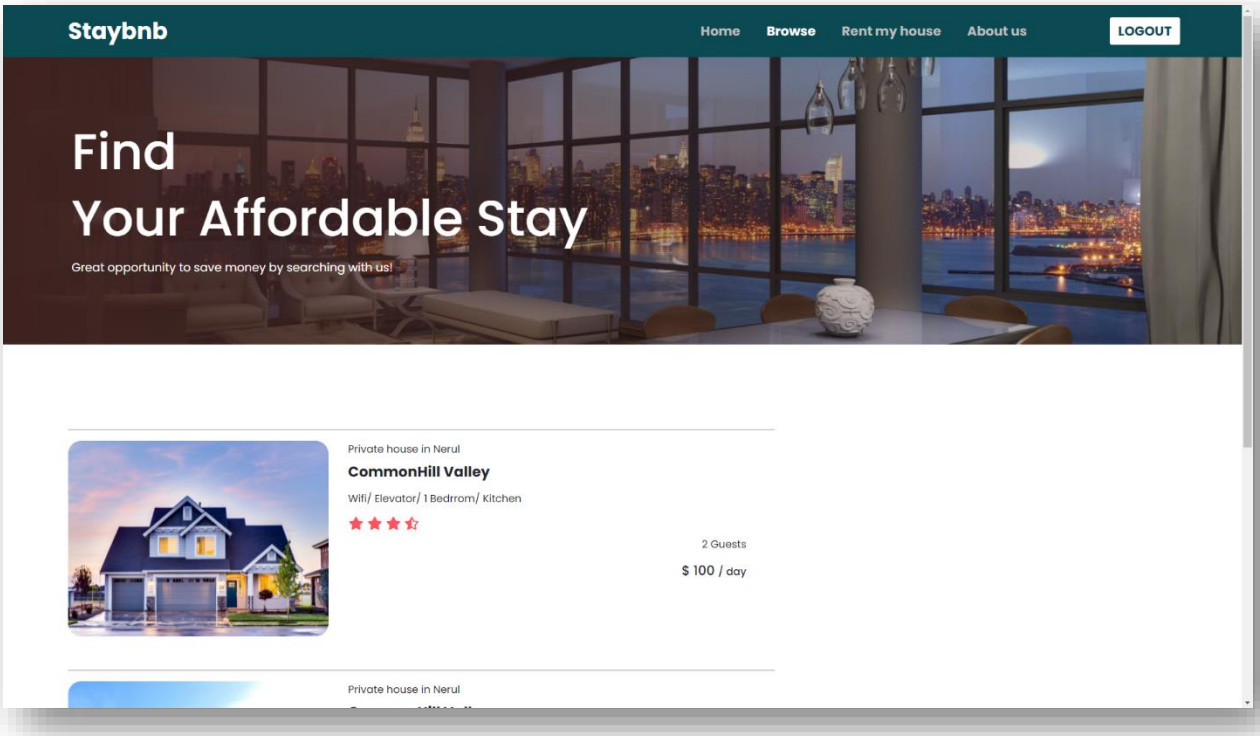

Fig 5.1.9. Browse (Top)

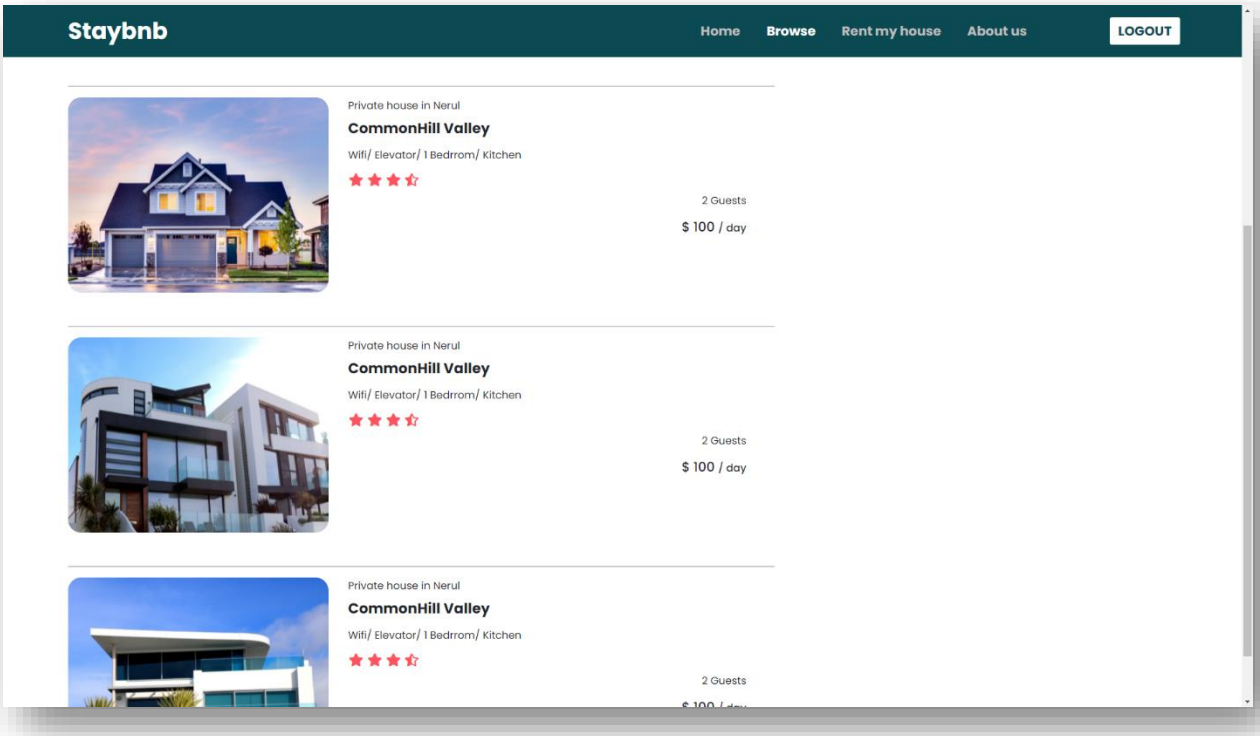

Fig. 5.1.10. Browse (Scroll)

5.2. Functioning

The application architecture and infrastructure come together to deliver a simple user experience on our housing rental platform. Before accessing the website, the user is prompted to create an account by providing the following details:

- Email Address
- Password (of his/her choice)
- Full Name
- Mobile Number

This simple registration happens through two pages as seen in figures 5.1.4. and 5.1.5. In the first page, the user must also agree to the terms and condition of the website. In the second page, they may verify their email address by clicking on the link to ensure they've entered the correct email.

This is possible due to Google Firebase - the real time No-SQL database which has been linked to the website via Firebase APIs It stores the user's data securely using a Unique Identification Number (UID).

Once the user has successfully registered, the webpage notifies the user on the client side and is prompted to login using the created credentials. Once logged in, the user will arrive on the home page (Fig. 5.1.1.) Similar to the about page (Fig. 5.1.2), the home page provides a simple overview of the application. The about page states the website's mission and other details.

Coming to the main functions, the browse page (Fig. 5.1.9.) is where users can view all the listings of properties for rent. The interface does this by fetching the details of rental properties from the cloud database and displaying those details as formatted objects - resulting in a more streamlined & simplified view of available housing as seen in figure 5.5.10.

To add to the list of properties in the browse portal for others to view, the user can upload the details of their own property which they wish to rent by filling out the details in the format provided by the input text boxes shown in figure 5.1.8. This includes the name and location as well as rent to be charged per day, along with a photograph of the property. Users can check the boxes which indicate the various amenities provided by their rental property.

A unique feature of this page is that the text fields for email address and mobile number is included by default, using the details stored in Google Firebase.

All pages of the website include the user navigation bar, so that he/she may switch between the pages – Home, Browse, Rent, and About - as required.

The above section can be summarized with the following flowchart:

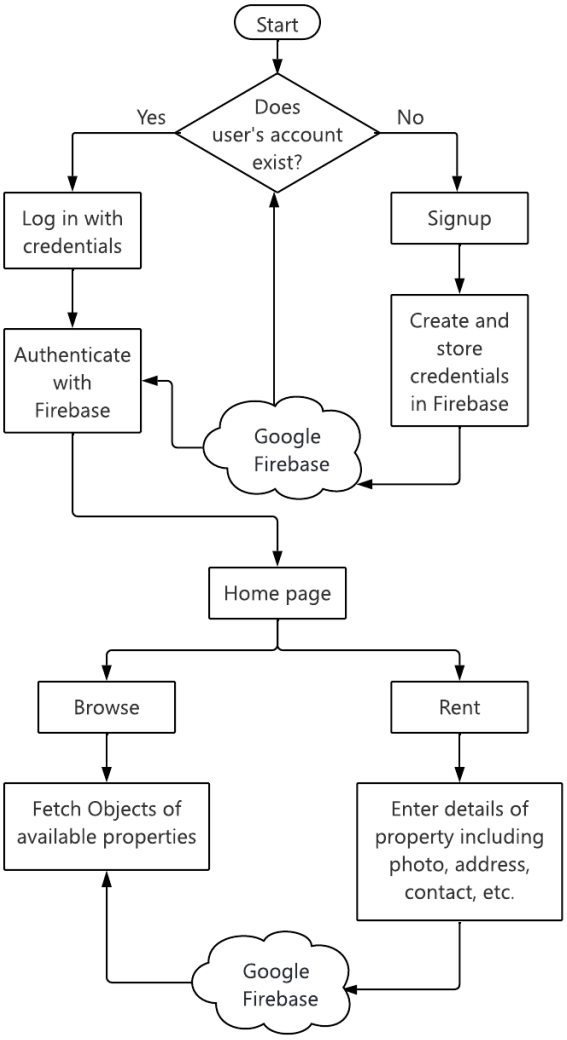

Fig. 5.2.1. User Experience Flowchart

5. Conclusion & Future Scope

In conclusion, we have successfully implemented a web application that allows users to browse and rent properties through the cloud. Registration too is completely free and authenticated using cloud services, making our application simple, robust, and efficient. Thanks to cloud services such as Google Firebase and AWS, we were able to quickly upload and configure our application to meet our site's needs.

The scope of the project lies in the possibilities for expansion. Rental solutions have been key to addressing India's housing challenges, and the country's rental real estate holds immense potential. In 2017, the rental real estate market was pegged at one crore units and was valued at $22 billion (Rs 1.53 lakh crore). In 2019, India's residential rental market was worth more than USD 20 billion, of which 68% or USD 13.5 billion is in urban areas. By 2023, its volume is expected to be 1.8 crore and valuation $41 billion (Rs 2.85 lakh crore). Our application provides a system to expand this scope – especially in metropolitan regions by configuring the location of the servers hosting the site.

Working on this project gave us the opportunity to test our understanding of cloud computing services; how different services would be extended on a larger scale project, as well as how multiple services come together to provide greater elasticity to the site's functions.

More importantly, we got the chance to get some hands-on project-based learning and establish a workflow for developing cloud-based applications.

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Literature Survey

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Implementation

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