THE HAND BOOK

A Minor Project report for the evaluation & partial fulfilment of the requirement for the award of the degree

B. TECH COMPUTER SCIENCE AND ENGINEERING

SUBMITTED BY:

CS – 15

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CERTIFICATE

The undersigned certify that Suryansh Shahi (19/BCS/103), Ritviz Mishra (19/BCS/128), Tanisha Tyagi (19/BCS/104), Nishant Paliwal (19/BCS/067) are registered for the B. Tech Programme in the Department of Computer Science and Engineering.

I hereby inform that the work embodied in project entitled 'THE HANDBOOK' be accepted for the partial fulfilment of the requirements for the evaluation and award of the B. Tech degree submitted to the School of Information and Communication Technology, Gautam Buddha University, Greater Noida is an authentic record of our own work carried out under the supervision of Ms. Jyoti Kaurav, University School of Information Communication and Technology.

Ms. Jyoti Kaurav

SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY GAUTAM
BUDDHA UNIVERSITY, GREATER NOIDA, 201312, U. P., (INDIA)

Candidate's Declaration

We, hereby, certify that the work embodied in this project report entitled "The HandBook" by us in partial fulfilment of the requirements for the award of the degree of B.Tech. in Computer Science & Engineering submitted to the School of Information and Communication Technology, Gautam Buddha University, Greater Noida is an authentic record of our own work carried out under the supervision of Ms. Jyoti Kaurav School of ICT. The matter presented in this report has not been submitted by me in any other University / Institute for the award of any other degree or diploma. Responsibility for any plagiarism related issue stands solely with us.

Signature of the Students:

Names:	Signature:
Suryansh Shahi	……………………………..
Ritviz Mishra	……………………………..
Tanisha Tyagi	……………………………..
Nishant Paliwal	……………………………..

This is to certify that the above statement made by the candidates is correct to the best of my knowledge and belief. However, responsibility for any plagiarism related issue solely stands with the students.

Signature of the Supervisor...

Name with Designation...

Date:

Place: Greater Noida

ACKNOWLEDGEMENT

A project work of this magnitude is not possible without the help of several people directly or indirectly. It is with immense satisfaction that we present a project report entitled "THE HANDBOOK".

We wish to express our sincere thanks to Ms. Jyoti Kaurav, Project Guide, for his valuable suggestions and continuous support which helped a lot in completing this project.

We like to express our deepest gratitude to the staff of Department of Computer Science and Engineering for their help to complete our project. We are extremely grateful to all the faculty for providing us with unwavering guidance and support.

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ABSTRACT

In today's fast paced world, time has become the most valuable asset and preserving and conserving it is the best practice us human beings can follow. As the world is expanding in terms of population and resources, and ironically shrinking with the expansion of technologies such as AI, ML, Nano – Technologies among other state of art technologies, it is very necessary that we make our actions brisk and thoughts less complicated.

Bil Keane put it very accurately,

"Yesterday's the past, tomorrow's the future, but today is a gift.

That's why it's called the present."

So, why should we waste this 'present' and that's where the concept of this project comes into being.

The main idea of this project titled "THE HANBOOK" revolves around aiding in the simplification of the complex day – to – day tasks of the user, over the internet. It provides one stop solution to the users, who have to use several different applications to store their documents, keep track of their transactions over a period of time, track upcoming events and schedule the tasks, and access the incoming mails. Here the user base we are talking about involves mainly the college students, working professionals and even the non – working adult population.

We used the trending, and emerging technologies, and tools in the implementation of this project. The web application has been implemented in three major steps namely – Authentication & Security, Front – End, and Back – End.

Authentication and Security involves access based on Facial Recognition developed via Machine Learning followed by a password verification. Front – End involves major technologies as the React.js, and Bootstrap. The Back-End is built using Node.js, MongoDB database and provided endpoints and functionality using APIs.

ABBREVIATIONS

ABBREVIATED	EXPANDED
AI	Artificial Intelligence
ML	Machine Learning
API	Application programming interface
Cv2	Open CV
NP	NumPy
TF	TensorFlow
CSS	Cascading Styles Sheet
HTML	Hyper Text Markup Language
JS	JavaScript

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1. Introduction

1.1. Problem

Time Constraints

In today's fast paced world, time has become the most valuable asset and preserving and conserving it is the best practice us human beings can follow. As the world is expanding in terms of population and resources, and ironically shrinking with the expansion of technologies such as AI, ML, Nano – Technologies among other state of art technologies, it is very necessary that we make our actions brisk and thoughts less complicated.

Work Complexity

a. **Students:** The students have so many works to handle at a time, the classes, notes, assignments and its submission, their documents – fee receipt, aadhar card, pan card etc. It could get clumsy sometimes, and that's when dropbox comes in.

b. **Working Professionals:** They've to keep track of their scheduled meetings, final submissions, their documents, track the transactions they've been making and have to keep a constant eye on the incoming mails and have to constantly reply to it.

c. **Non – working mass:** For e.g., homemakers have to track monthly spending of the household, then again, they've a social life which involves parties and events, they too need to preserve their documents, several bills.

1.2. Solution Proposed

It is very necessary to provide the user with the solution which is long lasting and could be trusted upon, by creating the Handbook we want to assure them of the security along with the simplicity of the work load and better time management.

Services provided by the Handbook:
- Mail Inbox and Compose
- Calendar

- Transaction Tracking and Payment Gateway
- A Dropbox for Documents

1.3. Scope

This application is going to be a huge success in the way that, a major chunk of the population will get benefitted from this one stop solution we application.

Population that will get benefitted are:
- College Students
- Working Professionals
- Non – working mass, etc.

1.4. Objective

- **E-mail Service –** The app provides the platform where user can easily communicate via e-mail.
- **Notepad –** The app also provides user with facility of adding quick notes anytime they need.
- **Dropbox –** The app helps user to keep their data save in the dropbox of the app.
- **Transaction –** The users transaction record is kept safe in the app.
- **Calender -** The important events date can be marked into the calender.

Thus, the apps main objective is to provide user with all the mentioned facilities with the best of quality and security.

1.5. Possible Outcomes

It provides one stop solution to the users, who have to use several different applications to store their documents, keep track of their transactions over a period of time, track upcoming events and schedule the tasks, and access the incoming mails. Here the user base

we are talking about involves mainly the college students, working professionals and even the non – working adult population.

This app can be a big success for the people who are troubled over the internet performing multiple tasks included in our app.
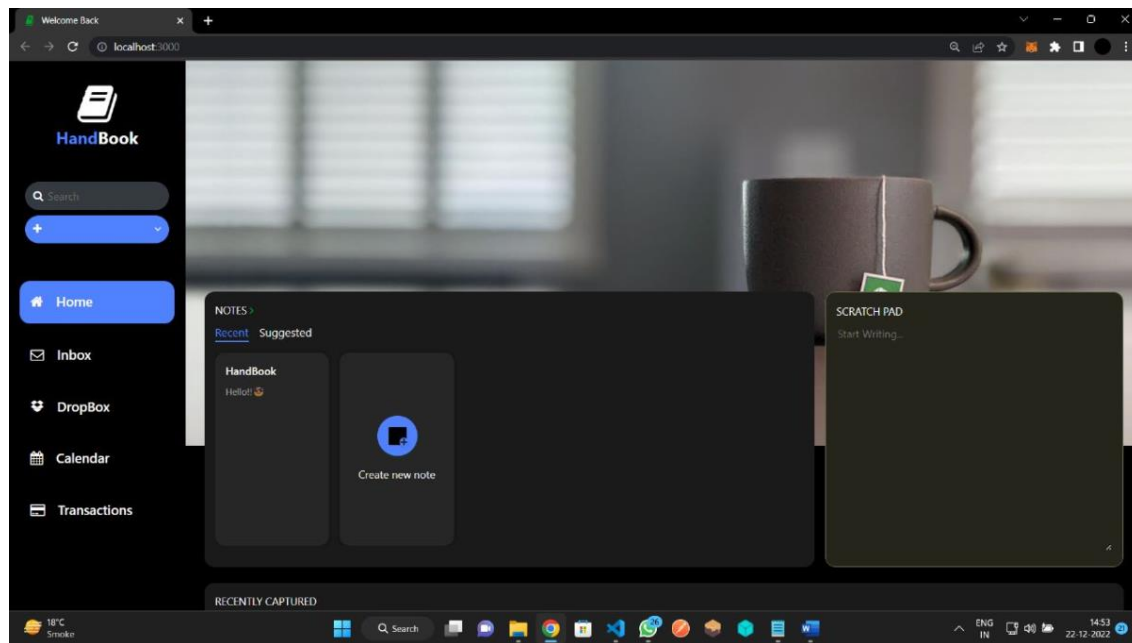
2. Tools and Technologies

2.1. Setup

The app comprises of the Home page at the beginning when it opens. The homepage displays multiple options onto which the user can land.

The options provided are as follows:

- Search
- Home
- Inbox
- Drop Box
- Calendar
- Transactions
- Notes
- Scratch Pad
- Recently Captured

Fig. 2.1 Homepage

2.2. Authentication and Security

The app keeps the user data secure since the app provides high level security and authenticity.

Login authentication is the most common scenario where we're asked to authenticate ourselves. In this technology-driven modern world, authentication plays a crucial role, and login authentication is perhaps the most common scenario when we're asked to authenticate ourselves. Login authentication, in the simplest words, is the way of confirming the identity of a user while they access their profile on a particular platform. Admit it; we all have been using passwords for years to prove our identity on various platforms to access specific resources or information. However, things have been rapidly transposing since the introduction of hassle-free authentication mechanisms.
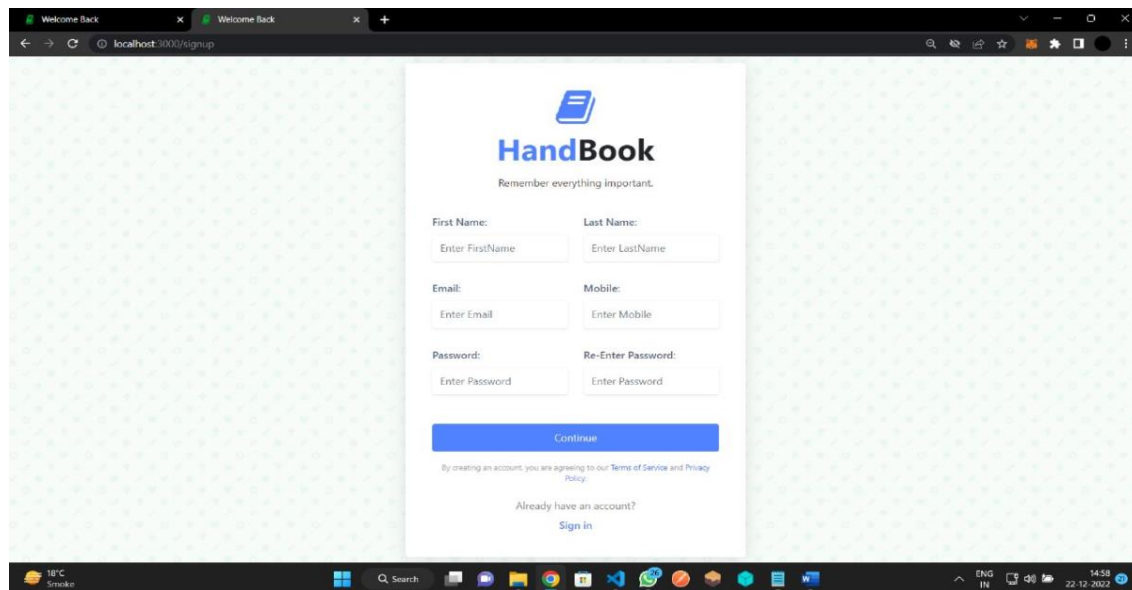
When we talk about login authentication, it's divided into two major categories:

1. Human to machine login authentication
2. Machine to machine login authentication

There is a requirement for specific credentials in any of the above types of authentication. In human verification, we have a user ID and password set by the consumer, while for machines, we have certificates and IP addresses, along with other information.
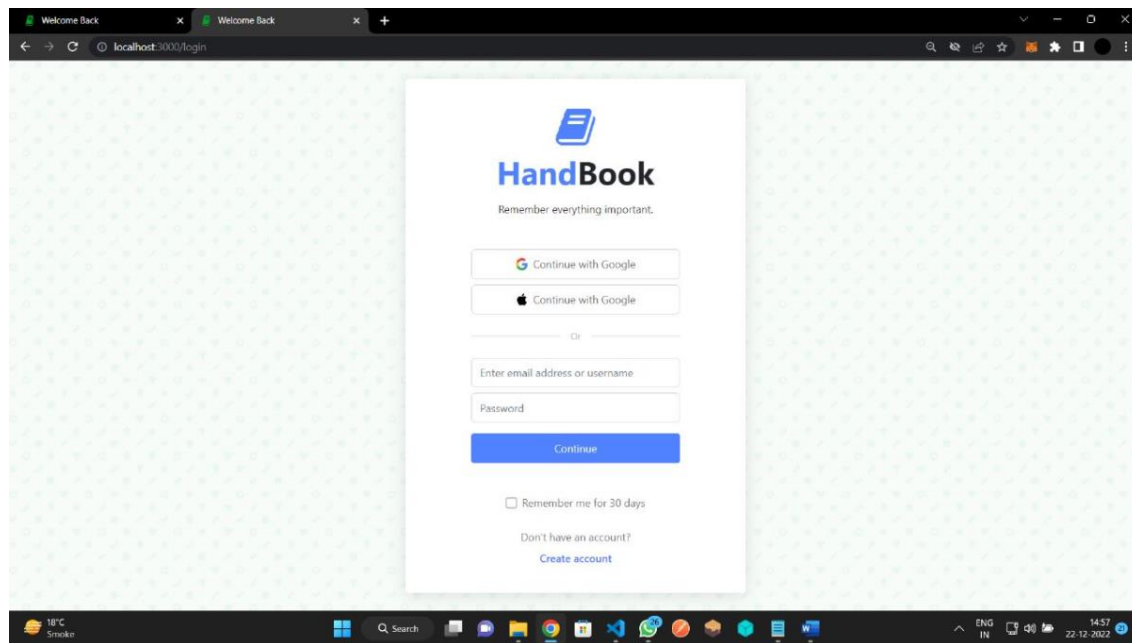
Generally, a consumer has to select or create a User ID and corresponding password for that unique ID that the system will use to verify user credibility.

We have used Human to machine login authentication in our project.

Fig. 2.2 Signup

Fig. 2.3 Login

## 2.3. Front- End Section

The front-end used for the project is React.js which is the most widely used front-end javascript library.

React is the most popular JavaScript library for building user interfaces. It is fast, flexible and it also has a strong community sitting online to help you every time. The coolest thing about React is it's based on components, you break down your complex code into individual pieces i.e. components and that helps developers in organizing their code in a better way. A lot of companies are moving to React and that's the reason most of the beginners and experienced developers also expanding their knowledge learning this library. React.Js is a declarative, efficient, and flexible JavaScript library for building reusable UI components. It is an open-source, component-based front end library which is responsible only for the view layer of the application. It was initially developed and maintained by Facebook and later used in its products like WhatsApp & Instagram.

Instead of manipulating the browser's DOM directly, React creates a virtual DOM in memory, where it does all the necessary manipulating, before making the changes in the browser DOM. React finds out what changes have been made, and changes only what needs to be changed. It is maintained by Meta and a community of individual developers and companies.

The code for the front-end part is shown below:
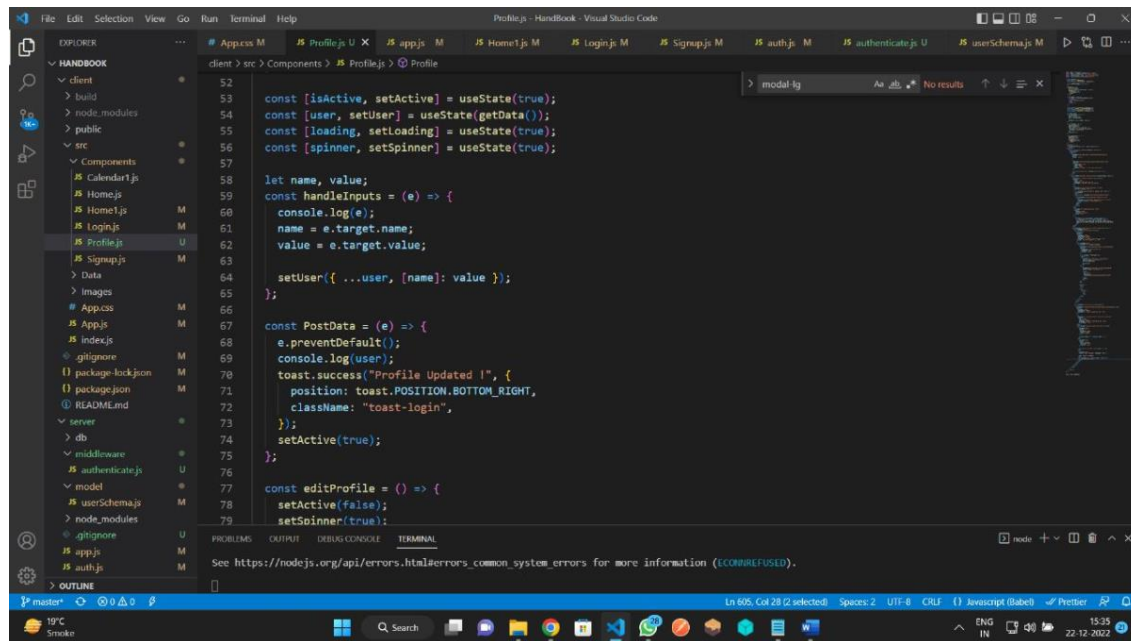
Fig. 2.4 Fetching User profile data

2.4. Back – End Section

The Back-End used for this project is Node.Js. Node.js is an open-source and cross-platform JavaScript runtime environment. It is a popular tool for almost any kind of project!   Node.js runs the V8 JavaScript engine, the core of Google Chrome, outside of the browser. This allows Node.js to be very performant.   A Node.js app runs in a single process, without creating a new thread for every request. Node.js provides a set of asynchronous I/O primitives in its standard library that prevent JavaScript code from blocking and generally, libraries in Node.js are written using non-blocking paradigms, making blocking behavior the exception rather than the norm.
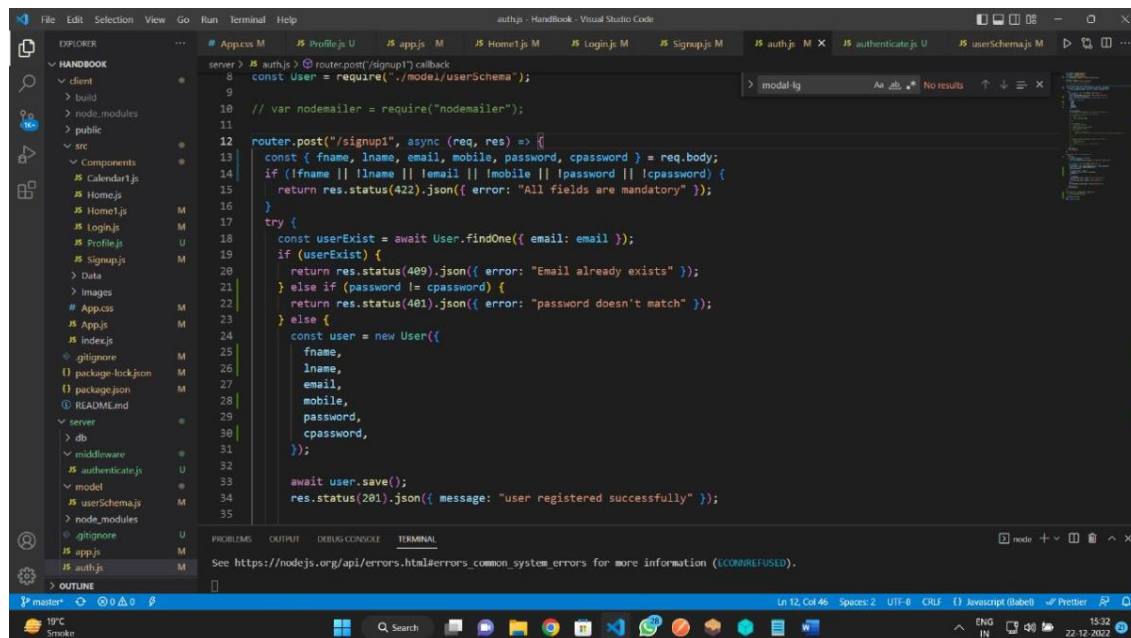
When Node.js performs an I/O operation, like reading from the network, accessing a database or the file system, instead of blocking the thread and wasting CPU cycles waiting, Node.js will resume the operations when the response comes back. This allows Node.js to handle thousands of concurrent connections with a single server without introducing the burden of managing

thread concurrency, which could be a significant source of bugs. Node.js has a unique advantage because millions of frontend developers that write JavaScript for the browser are now able to write the server-side code in addition to the client-side code without the need to learn a completely different language.
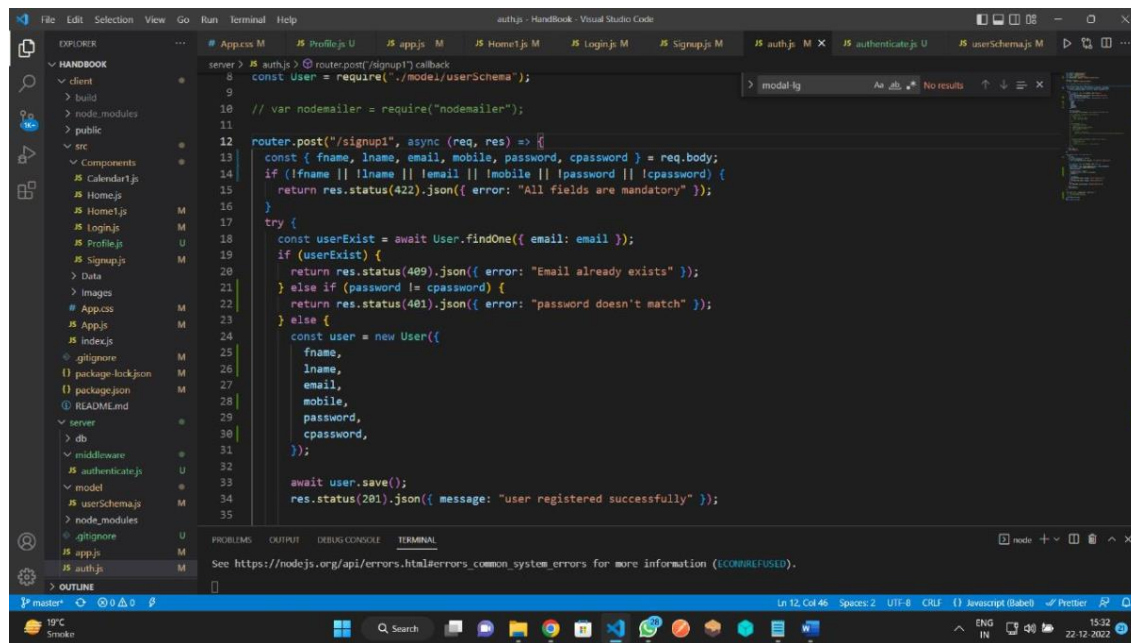
In Node.js the new ECMA Script standards can be used without problems, as you don't have to wait for all your users to update their browsers - you are in charge of deciding which ECMA Script version to use by changing the Node.js version, and you can also enable specific experimental features by running Node.js with flags.

The code for the Back-End is shown below:

Fig. 2.5 Login Code

Fig. 2.6 Signup Code

3. Project Module

3.1. Project Overview

The main idea of this project titled "THE HANBOOK" revolves around aiding in the simplification of the complex day – to – day tasks of the user, over the internet. It provides one stop solution to the users, who have to use several different applications to store their documents, keep track of their transactions over a period of time, track upcoming events and schedule the tasks, and access the incoming mails. Here the user base we are talking about involves mainly the college students, working professionals and even the non – working adult population.

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technologies as the React.js, and Bootstrap. The Back-End is built using Node.js, MongoDB database and provided endpoints and functionality using APIs.

The key features of the project are as follows:

- Login
- Sign up
- ML based Login/Signup using Facial Recognition
- Visit User Profile
- Edit User Profile
- Text Editor
- Send E-mail
- Upload Images
- Upload Documents
- Calendar to schedule an event
- Voice recording

3.2. Implementation Overview

Implementation simply means carrying out the activities described in your work plan. Executing a project is a very complex mission, as it requires the coordination of a wide range of activities, the overseeing of a team, the management of budget, the communication to the public, among other issues. The project implementation looks like this:

a) **Login**

This is the first page user will see on opening this website. It is a simple login page asking Email and Password to get access to your account.

Used a secure authentication for login & signup i.e., we have used jwt tokens for verifying users. Whenever a user login's a token gets generated and gets stored in cookies, and will keeping matching the token stored in the cookies and the token we have, the moment token didn't match will end the user's session and user gets logged out. We have set a normal expiry of generated token to 30 days i.e., after 30 days the token will automatically get expired.
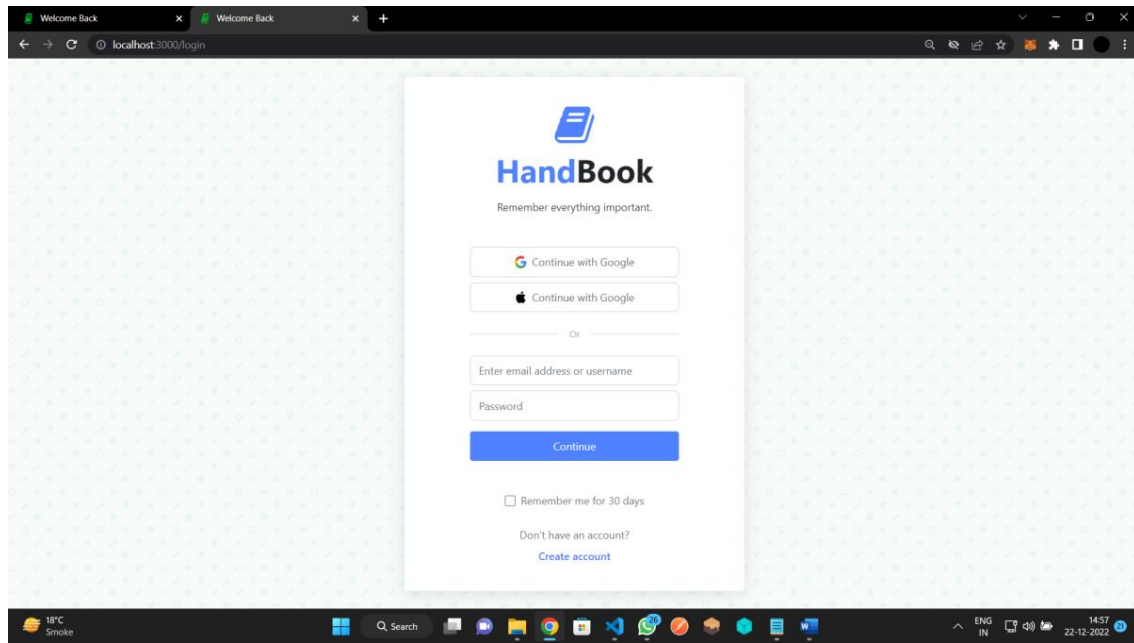
Fig. 3.1 Login Page

If a user want to logout, just need to click on logout button, doing this we are basically removing the token stored in cookies, so that when the server matches the token present in the database with the token pesent in cookies, it wouldn't match since, we have already removed the token. So like this user gets logged out.

b) Signup

It is a simple signup page asking FirstName, LastName, Email, Mobile, Password & Confirm Password for creating user account.

All fields are mandatory for creating an account, if user forgot to fill any input field error message will pop-up saying "All fields are mandatory". If password and confirm password fields didn't match will throw an error saying "Confirm Password didn't match".

Also, it firstly checks in the database that the entered email is present in the database or not, if not then only it allows to register otherwise throws an error saying "Email already exists".
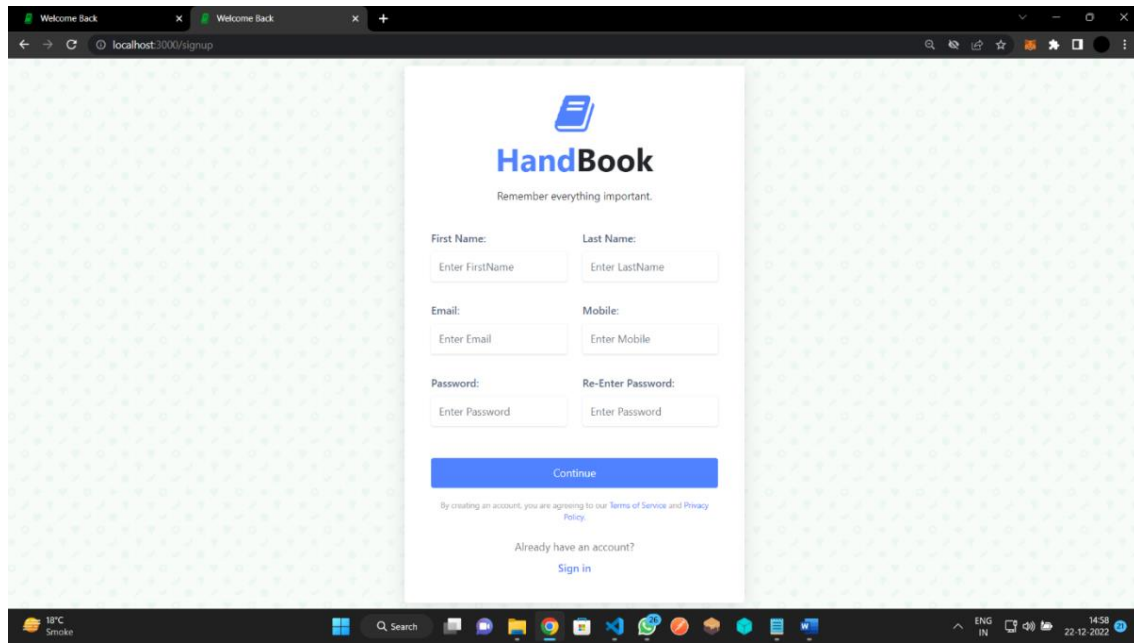
Fig. 3.2 Signup Page

c) **Loader**

We have provided a multiple loaders to this website, whenever user make's a request for something the loader will be displayed till then the requested data is displayed to the user.
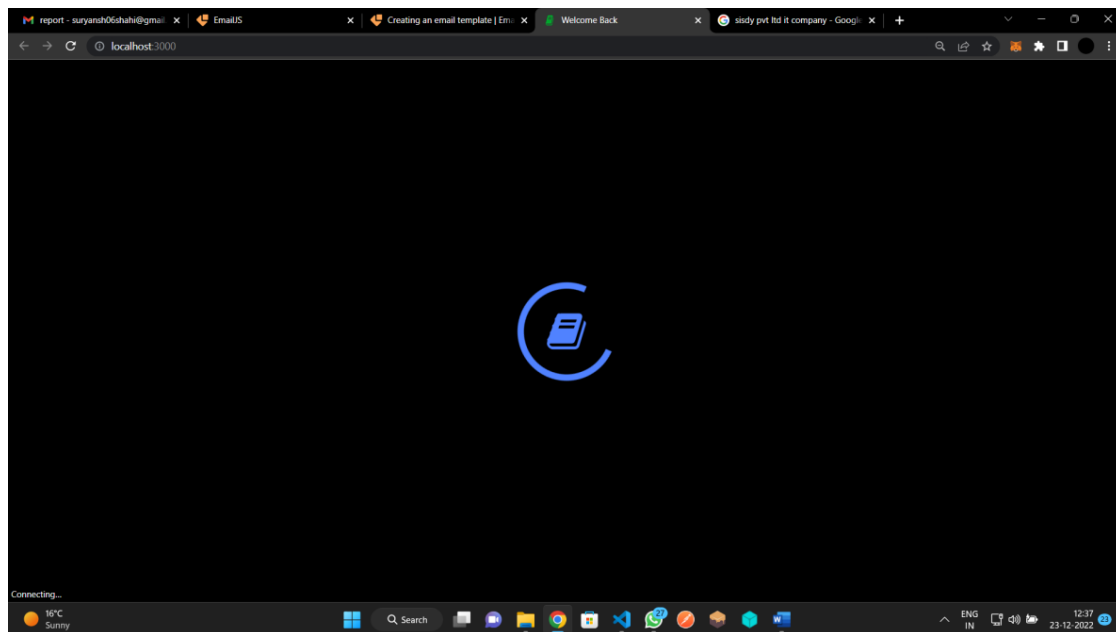
Fig. 3.3 Loader

d) **Landing Page**

This is the home page or we can say landing page where the user will be directed after successful login. It comprises of various tabs named- "Home", "Inbox", "Compose Email", "Calendar", "Transactions".

On Top-right corner there is a user profile icon, on clicking user will be redirected to the user profile.

There is a section named "notes" where there is a card "Create new note", on clicking on it a Text Editor will pop-up.
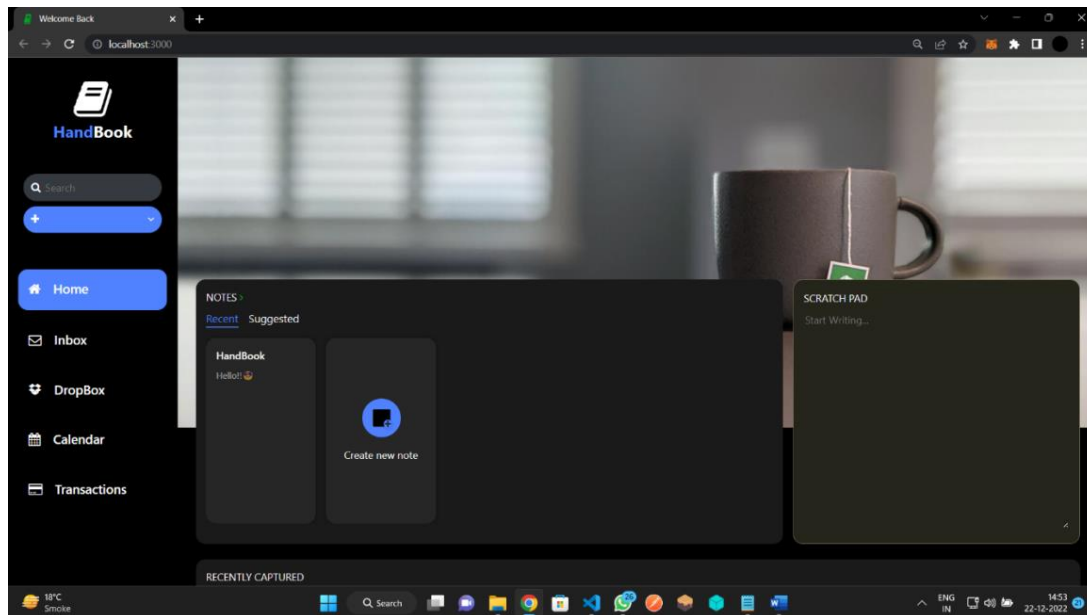
Fig. 3.4 Landing Page

i. **Text Editor**

We have provided a text editor to our application so that if user want to make some quick notes, can easily open text editor just by clicking on "Create a note" card present on home/landing page.
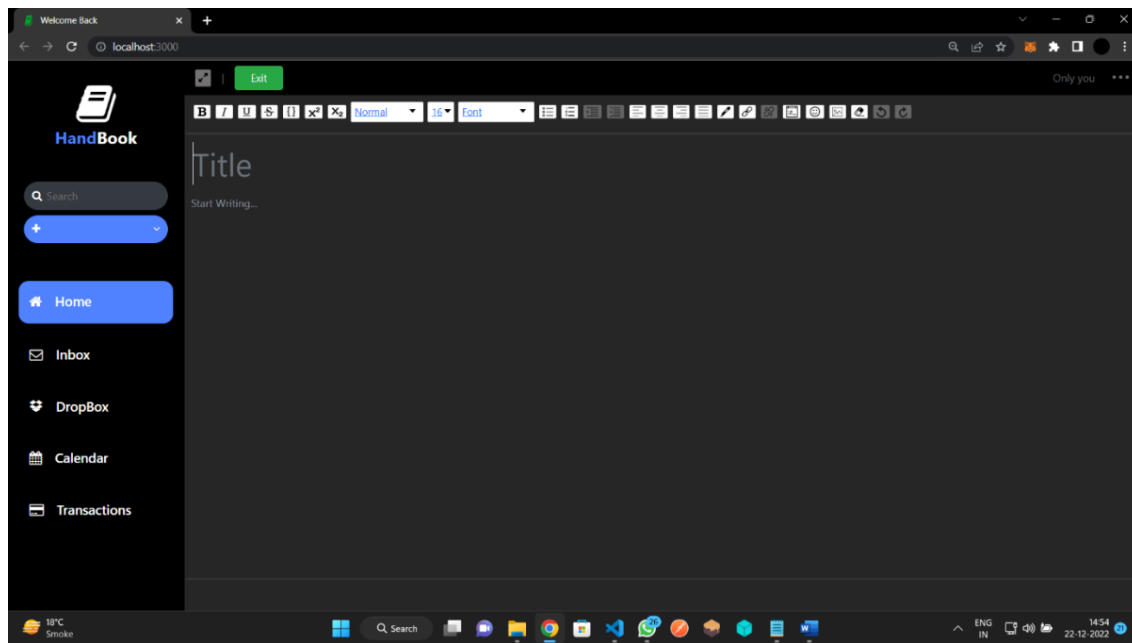
Fig. 3.5 Text Editor

Here user have to provide a title to the note, on giving title attribute will see a save button gets reflected on top-right corner & after that user can start writing the note. Also, we can toggle full screen mode in text editor just by clicking on expand icon present on top-left corner of text-editor.

Text Editor provides various features like, we can change font size, font style, font family, color, can add emojis, align text etc.

When we are done with our note, have to click on save button present on top in order to save our note. On clicking our note will get saved and will be redirected to the home page and now we can clearly see our that our note have been added to the notes section.

e) **User Profile**

There is a user profile icon on top-right corner of home page, on clicking user will be redirected to the user's profile. User can read all the details provided by user and also can update them.
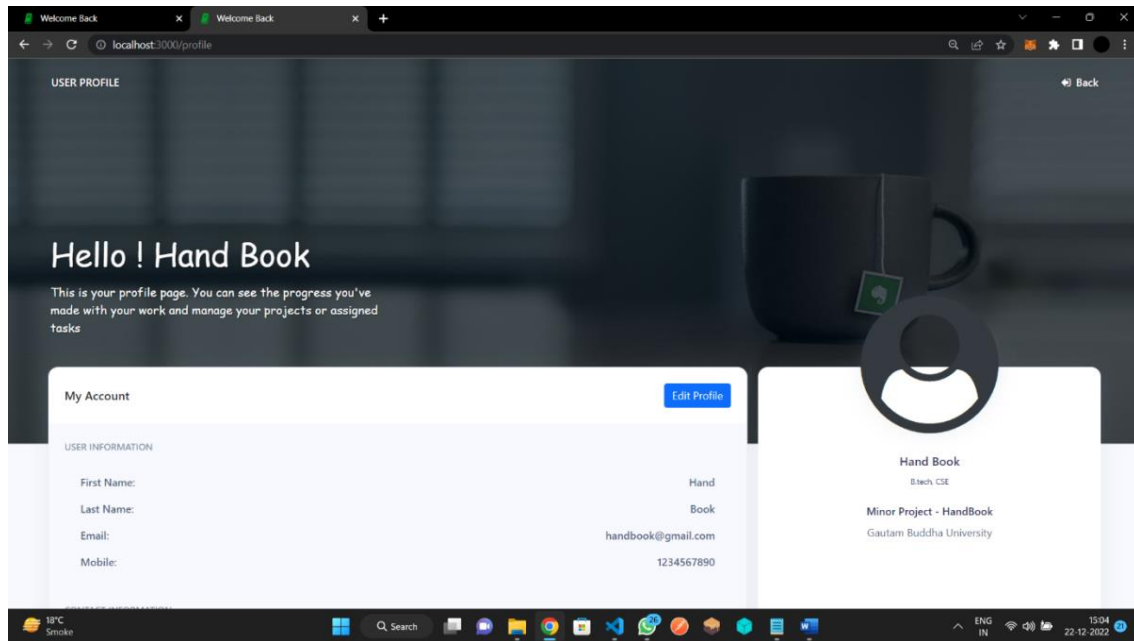
Fig. 3.6 User Profile

On clicking the edit profile button a form will open where user can add/update the input fields if required, can also upload a profile picture. After adding the details, have to click on save button in order to save the updated information. On clicking save will see all the updated fields gets populated will the newly entered data.
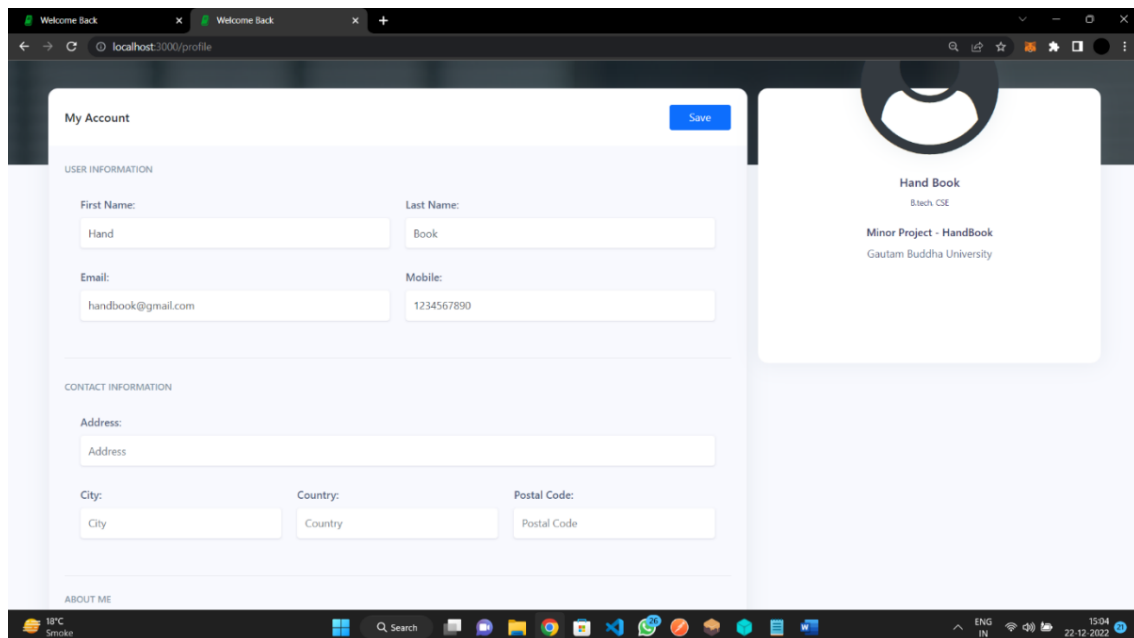
Fig. 3.7 Update User Profile

f) Compose Email

Used Emailjs for sending mails, user can send emails to anyone

Our service sends emails as multipart related! This means that emails contain HTML and plain text. If HTML is not supported or denied, the text part will be displayed.

EmailJS helps to send emails using client-side technologies only. No server is required – just connect EmailJS to one of the supported email services, create an email template, and use one of our SDK libraries to trigger an email.

Additionally, you can easily add attachments, require CAPTCHA validation, switch between email services without making code changes, review the history of the email request, and more.

How does it work?

- **Connect your email service**
  Choose from a wide variety of email services.
  Emailjs support both <u>transactional</u> email services (Mailgun, Mailjet, Mandrill, SendinBlue, SendGrid, Amazon SES and Postmark) and <u>personal</u> email services (AOL, Gmail, FastMail, iCloud, Mail.ru, Outlook, Yahoo, Yandex and Zoho).

- **Create email template**
  Easily build your own template. Choose the tool most suitable for you: text editor or code editor. Templates are parameterized so that you can further customize them from your code.
  The content of the template will be pretty simple:

```
{{ message }}
{{ user_name }} ({{ user_email }})
```

Where the message variable will contain the content of the message. The user_name and user_email are the user's name and user's email address, respectively.

- **Send email from your code**

  Add one of our SDK, and start sending emails!

```
emailjs
    .sendForm(
      "service_bdy40vm",
      "template_dwlucdq",
      form.current,
      "lCP5fKsL73HkyO8v6"
    )
    .then(
      (res) => {
        toast.success("Message Sent !", {
          position: toast.POSITION.BOTTOM_RIGHT,
          className: "toast-message",
        });
        console.log(res.text);
      },
      (err) => {
        toast.warn("Message not sent !", {
          position: toast.POSITION.BOTTOM_RIGHT,
          className: "toast-message",
        });
        console.log(err.text);
      }
    );
```
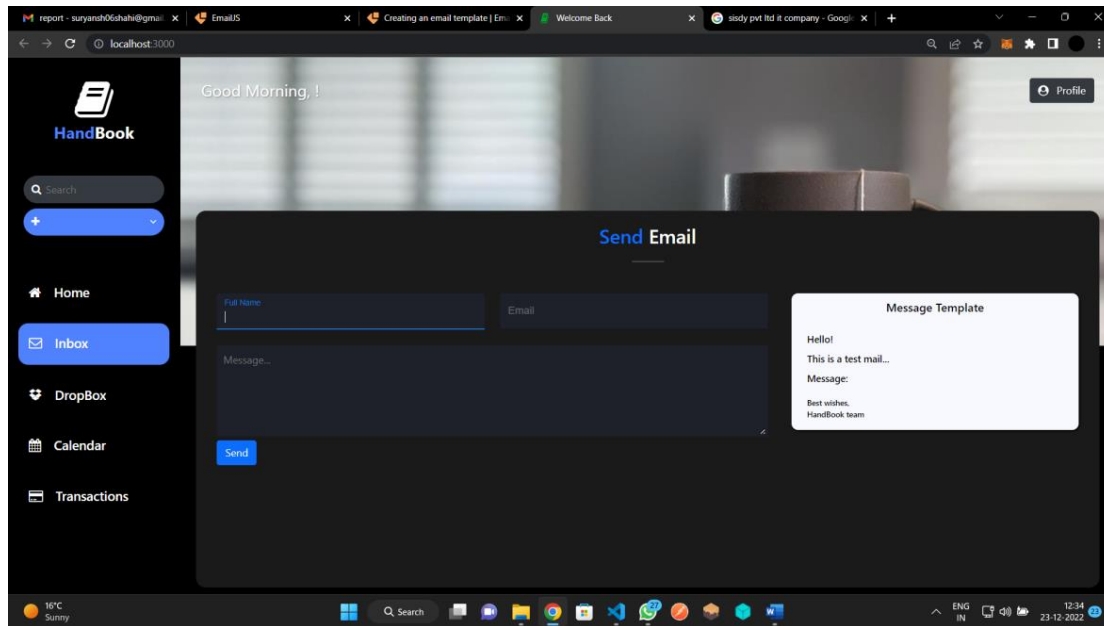
Fig. 3.8 Compose Email

g) Dropbox

User can upload documents, images, audio, video files in this section and can access them from anywhere, anytime on anydevice connected to internet. Also, we have provided CRUD functionality in our application i.e., user easily Create, Read, Update & Delete items.

i. Adding Images

User can easily upload images, just by clicking a button named "Upload Images", after clicking a dailog box will appear asking to select the images user want to upload (user can select multiple images). On submiting the selected images will be displayed on the screen.

Also, user can preview uploaded images and delete them also, if required at any point of time.
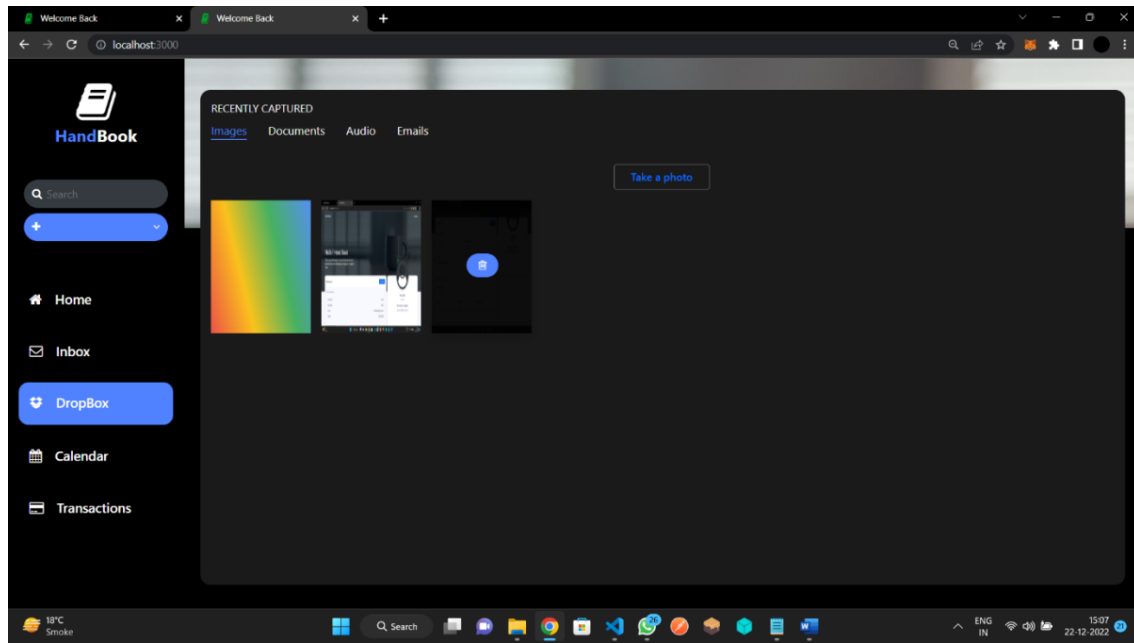
Fig. 3.9 Adding Images

ii.   **Adding Documents**

User can easily upload images, just by clicking a button named "Save Documents", after clicking a dailog box will appear asking to select the images user want to. On submiting the selected Document will be displayed on the screen.

Also, user can preview uploaded Documents and delete them also, if required at any point of time.
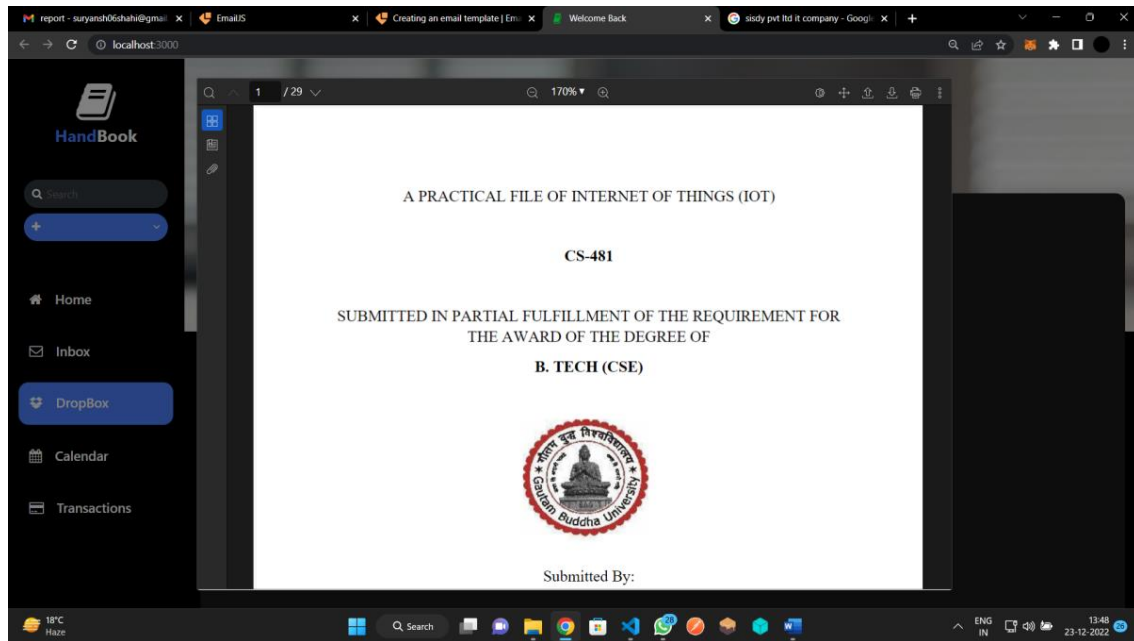
Fig. 3.10 Adding Documents

h) **Calendar**

User can manage their schedule using this calander and can also set remainder. We have list all the festive holidays in this calendar user can easily switch to next / previous month, and see how many holidays are their in that particular month.
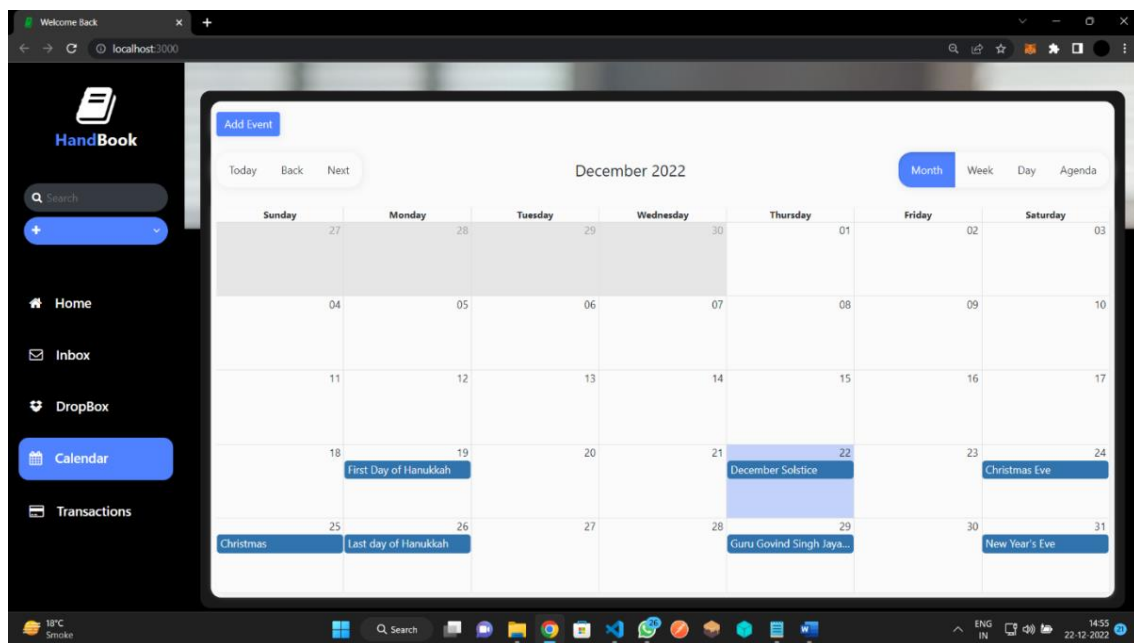
Fig. 3.11 Calendar

Add an Event:

User can easily schedule an upcoming event in this calendar, just by clicking on "Add Event" button. On clicking add event button a modal will pop-up asking some input fields i.e., "Add Title", "Start Date" & "End Date". After submitting will see that the requested event is displayed on the calendar having name as given in "Add Title".
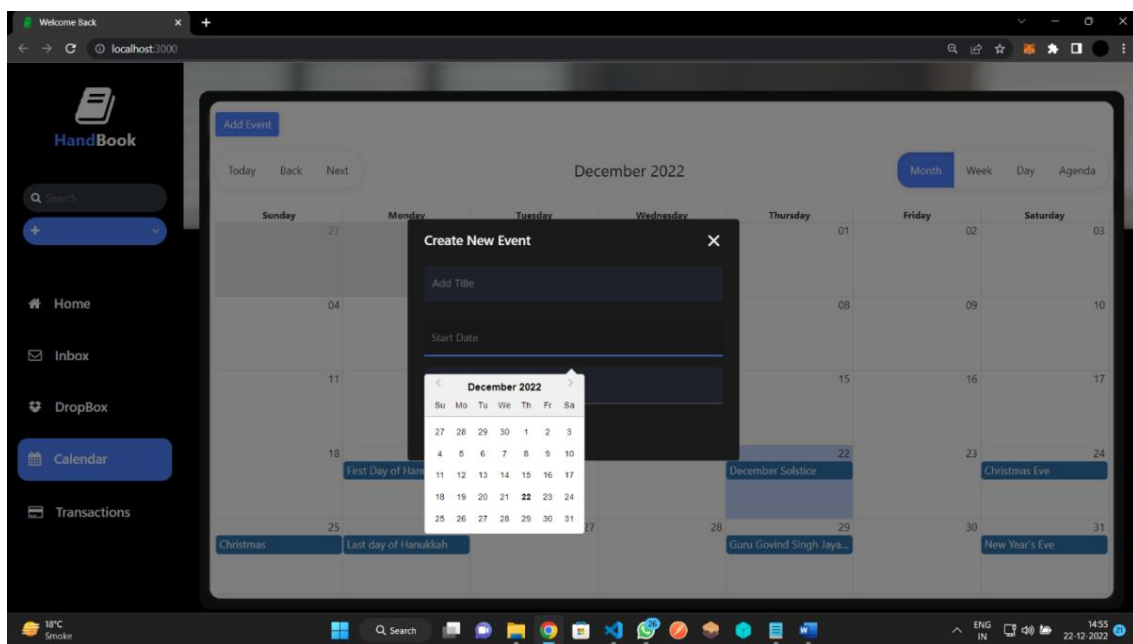
Fig. 3.12 Adding an Event

i) **Transactions**

This section represents all the successful, pending and failed transaction made by the user. And also visualizes them using charts like doughnut and line charts.

There we have provided 2 sections named Tabular View and Graphical View.
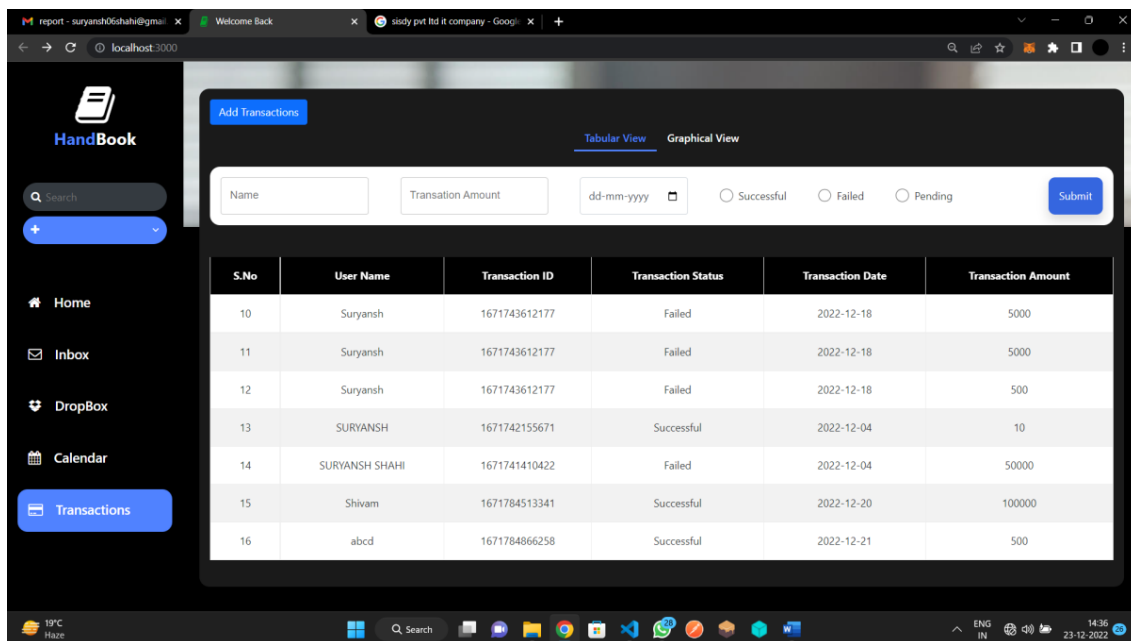
i. **Tabular View**

This consists of 2 things, is "add Transaction" and another one is the "tabular representation" of all the transactions. Add Transaction comprises multiple

input fields like, "User Name", "Transaction Amount", "Transaction Id", "Status" and "Date".

For adding a transaction details user need to provide all the above mentioned fields and click on submit button. On clicking submit button will see that the requested transaction gets listed in the transaction table.

User can update/edit the listed transaction details, can filter transactions by tag name as – "successful", "pending" & "failed". Also, can remove a particular transaction record if required.

Fig. 3.13 Tabular View

ii. **Graphical View**

We have provided graphical representation of all the transactions, as listed by the user. It shows all the "Successful Transactions", "Pending Transactions" and "Failed Transactions" in the form of circular progress bar's.

Also, visualizing the transactions details using Line charts and Doughnut charts.
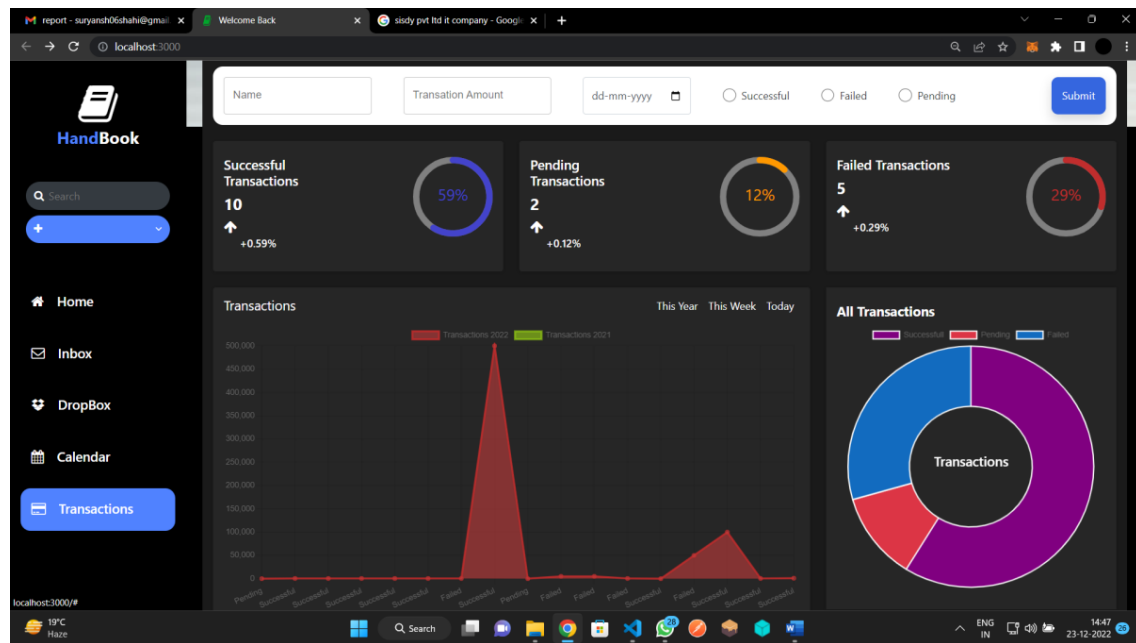
Fig. 3.14 Graphical View

4. Authentication Module

4.1. Face Recognition

Facial recognition is a way of identifying or confirming an individual's identity using their face. Facial recognition systems can be used to identify people in photos, videos, or in real-time.

Facial recognition is a category of biometric security. Other forms of biometric software include voice recognition, fingerprint recognition, and eye retina or iris recognition. The technology is mostly used for security and law enforcement, though there is increasing interest in other areas of use.

Many people are familiar with face recognition technology through the FaceID used to unlock iPhones (however, this is only one application of face recognition). Typically, facial recognition does not rely on a massive database of photos to determine an individual's identity — it simply identifies and recognizes one person as the sole owner of the device, while limiting access to others.

Beyond unlocking phones, facial recognition works by matching the faces of people walking past special cameras, to images of people on a watch list. The watch lists can contain pictures of anyone, including people who are not suspected of any wrongdoing, and the images can come from anywhere — even from our social media accounts. Facial technology systems can vary, but in general, they tend to operate as follows:

Step 1: Face detection
The camera detects and locates the image of a face, either alone or in a crowd. The image may show the person looking straight ahead or in profile.

Step 2: Face analysis
Next, an image of the face is captured and analysed. Most facial recognition technology relies on 2D rather than 3D images because it can more conveniently match a 2D image with public photos or those in a database. The software reads the geometry of your face. Key factors include the distance between your eyes, the depth of your eye sockets, the distance from forehead to chin, the shape of your cheekbones, and the contour of the lips, ears, and chin. The aim is to identify the facial landmarks that are key to distinguishing your face.

Step 3: Converting the image to data
The face capture process transforms analogue information (a face) into a set of digital information (data) based on the person's facial features. Your face's analysis is essentially turned into a mathematical formula. The numerical code is called a faceprint. In the same way that thumbprints are unique, each person has their own faceprint.

Step 4: Finding a match
Your faceprint is then compared against a database of other known faces. For example, the FBI has access to up to 650 million photos, drawn from various state databases. On Facebook, any photo tagged with a person's name becomes a part of Facebook's database, which may also be used for facial recognition. If your faceprint matches an image in a facial recognition database, then a determination is made.

Of all the biometric measurements, facial recognition is considered the most natural. Intuitively, this makes sense, since we typically recognize ourselves and others by looking at faces, rather than thumbprints and irises. It is estimated that over half of the world's population is touched by facial recognition technology regularly.

a) Advantages of face recognition

Aside from unlocking your smartphone, facial recognition brings other benefits:

Increased security
On a governmental level, facial recognition can help to identify terrorists or other criminals. On a personal level, facial recognition can be used as a security tool for locking personal devices and for personal surveillance cameras.

Reduced crime
Face recognition makes it easier to track down burglars, thieves, and trespassers. The sole knowledge of the presence of a face recognition system can serve as a deterrence, especially to petty crime. Aside from physical security, there are benefits to cybersecurity as well. Companies can use face recognition technology as a substitute for passwords to access computers. In theory, the technology cannot be hacked as there is nothing to steal or change, as is the case with a password.

Removing bias from stop and search
Public concern over unjustified stops and searches is a source of controversy for the police — facial recognition technology could improve the process. By singling out suspects among crowds through an automated rather than human process, face recognition technology could help reduce potential bias and decrease stops and searches on law-abiding citizens.

Greater convenience
As the technology becomes more widespread, customers will be able to pay in stores using their face, rather than pulling out their credit cards or cash. This could save time in checkout lines. Since there is no contact required for facial recognition as there is with fingerprinting or other security measures – useful in the post-COVID world – facial recognition offers a quick, automatic, and seamless verification experience.

Faster processing
The process of recognizing a face takes only a second, which has benefits for the companies that use facial recognition. In an era of cyber-attacks and advanced hacking tools, companies need both secure and fast technologies. Facial recognition enables quick and efficient verification of a person's identity.

Integration with other technologies
Most facial recognition solutions are compatible with most security software. In fact, it is easily integrated. This limits the amount of additional investment required to implement it.

b) Disadvantages of face recognition

While some people do not mind being filmed in public and do not object to the use of facial recognition where there is a clear benefit or rationale, the technology can inspire intense reactions from others. Some of the disadvantages or concerns include:

Surveillance
Some worry that the use of facial recognition along with ubiquitous video cameras, artificial intelligence, and data analytics creates the potential for mass surveillance, which could restrict individual freedom. While facial recognition technology allows governments to track down criminals, it could also allow them to track down ordinary and innocent people at any time.

Scope for error
Facial recognition data is not free from error, which could lead to people being implicated for crimes they have not committed. For example, a slight change in camera angle or a change in appearance, such as a new hairstyle, could lead to error. In 2018, Newsweek reported that Amazon's facial recognition technology had falsely identified 28 members of the US Congress as people arrested for crimes.

Breach of privacy
The question of ethics and privacy is the most contentious one. Governments have been known to store several citizens' pictures without their consent. In 2020, the European Commission said it was considering a ban on facial recognition technology in public spaces for up to five years, to allow time to work out a regulatory framework to prevent privacy and ethical abuses.

Massive data storage
Facial recognition software relies on machine learning technology, which requires massive data sets to "learn" to deliver accurate results. Such large data sets require robust data storage. Small and medium-sized companies may not have sufficient resources to store the required data.

c) How facial recognition is used

The technology is used for a variety of purposes. These include:

Unlocking phones
Various phones, including the most recent iPhones, use face recognition to unlock the device. The technology offers a powerful way to protect personal data and ensures that sensitive data remains inaccessible if the phone is stolen. Apple claims that the chance of a random face unlocking your phone is about one in 1 million.

Law enforcement
Facial recognition is regularly being used by law enforcement. According to this NBC report, the technology is increasing amongst law enforcement agencies within the US, and the same is true in other countries. Police collects mugshots from arrestees and compare them against local, state, and federal face recognition databases. Once an

arrestee's photo has been taken, their picture will be added to databases to be scanned whenever police carry out another criminal search.

Also, mobile face recognition allows officers to use smartphones, tablets, or other portable devices to take a photo of a driver or a pedestrian in the field and immediately compare that photo against to one or more face recognition databases to attempt an identification.

Airports and border control
Facial recognition has become a familiar sight at many airports around the world. Increasing numbers of travellers hold biometric passports, which allow them to skip the ordinarily long lines and instead walk through an automated ePassport control to reach the gate faster. Facial recognition not only reduces waiting times but also allows airports to improve security. The US Department of Homeland Security predicts that facial recognition will be used on 97% of travellers by 2023. As well as at airports and border crossings, the technology is used to enhance security at large-scale events such as the Olympics.

d) Applications of face recognition.

Finding missing persons
Facial recognition can be used to find missing persons and victims of human trafficking. Suppose missing individuals are added to a database. In that case, law enforcement can be alerted as soon as they are recognized by face recognition — whether it is in an airport, retail store, or other public space.

Reducing retail crime
Facial recognition is used to identify when known shoplifters, organized retail criminals, or people with a history of fraud enter stores. Photographs of individuals can be matched against large databases of criminals so that loss prevention and retail security professionals can be notified when shoppers who potentially represent a threat enter the store.

Improving retail experiences
The technology offers the potential to improve retail experiences for customers. For example, kiosks in stores could recognize customers, make product suggestions based on their purchase history, and point them in the right direction. "Face pay" technology could allow shoppers to skip long checkout lines with slower payment methods.

Banking
Biometric online banking is another benefit of face recognition. Instead of using one-time passwords, customers can authorize transactions by looking at their smartphone or computer. With facial recognition, there are no passwords for hackers to compromise. If hackers steal your photo database, 'liveless' detection – a technique used to determine whether the source of a biometric sample is a live human being or a fake representation – should (in theory) prevent them from using it for impersonation purposes. Face recognition could make debit cards and signatures a thing of the past.

Marketing and advertising

Marketers have used facial recognition to enhance consumer experiences. For example, frozen pizza brand DiGiorno used facial recognition for a 2017 marketing campaign where it analyzed the expressions of people at DiGiorno-themed parties to gauge people's emotional reactions to pizza. Media companies also use facial recognition to test audience reaction to movie trailers, characters in TV pilots, and optimal placement of TV promotions. Billboards that incorporate face recognition technology – such as London's Piccadilly Circus – means brands can trigger tailored advertisements.

Healthcare

Hospitals use facial recognition to help with patient care. Healthcare providers are testing the use of facial recognition to access patient records, streamline patient registration, detect emotion and pain in patients, and even help to identify specific genetic diseases. AiCure has developed an app that uses facial recognition to ensure that people take their medication as prescribed. As biometric technology becomes less expensive, adoption within the healthcare sector is expected to increase.

Tracking student or worker attendance

Some educational institutions in China use face recognition to ensure students are not skipping class. Tablets are used to scan students' faces and match them to photos in a database to validate their identities. More broadly, the technology can be used for workers to sign in and out of their workplaces, so that employers can track attendance.

Recognizing drivers

According to this consumer report, car companies are experimenting with facial recognition to replace car keys. The technology would replace the key to access and start the car and remember drivers' preferences for seat and mirror positions and radio station presets.

Monitoring gambling addictions

Facial recognition can help gambling companies protect their customers to a higher degree. Monitoring those entering and moving around gambling areas is difficult for human staff, especially in large crowded spaces such as casinos. Facial recognition technology enables companies to identify those who are registered as gambling addicts and keeps a record of their play so staff can advise when it is time to stop. Casinos can face hefty fines if gamblers on voluntary exclusion lists are caught gambling.

4.2. Machine Learning

a) What is machine learning?

Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values.

Recommendation engines are a common use case for machine learning. Other popular uses include fraud detection, spam filtering, malware threat detection, business process automation (BPA) and Predictive maintenance.
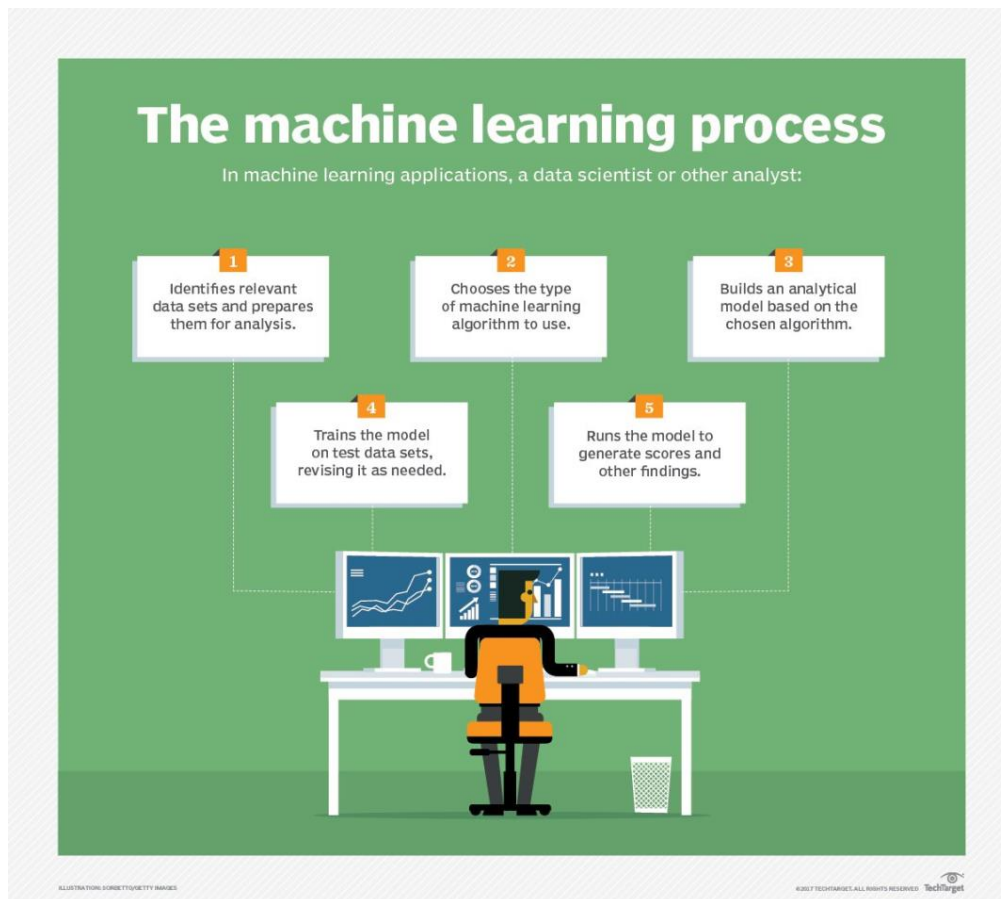
Fig 4.1 Machine Learning Process

b) Why is machine learning important?

Machine learning is important because it gives enterprises a view of trends in customer behaviour and business operational patterns, as well as supports the development of new products. Many of today's leading companies, such as Facebook, Google and Uber, make machine learning a central part of their operations. Machine learning has become a significant competitive differentiator for many companies.

c) What are the different types of machine learning?

Classical machine learning is often categorized by how an algorithm learns to become more accurate in its predictions. There are four basic approaches:supervised learning, unsupervised learning, semi-supervised learning and reinforcement learning. The type of algorithm data scientists chooses to use depends on what type of data they want to predict.

- **Supervised learning:** In this type of machine learning, <u>data scientists</u> supply algorithms with labelled training data and define the variables they want the algorithm to assess for correlations. Both the input and the output of the algorithm is specified.

- **Unsupervised learning:** This type of machine learning involves algorithms that train on unlabeled data. The algorithm scans through data sets looking for any meaningful connection. The data that algorithms train on as well as the predictions or recommendations they output are predetermined.

- **Semi-supervised learning:** This approach to machine learning involves a mix of the two preceding types. Data scientists may feed an algorithm mostly labelled <u>training data</u>, but the model is free to explore the data on its own and develop its own understanding of the data set.

- **Reinforcement learning:** Data scientists typically use <u>reinforcement learning</u> to teach a machine to complete a multi-step process for which there are clearly defined rules. Data scientists program an algorithm to complete a task and give it positive or negative cues as it works out how to complete a task. But for the most part, the algorithm decides on its own what steps to take along the way.

d) How does supervised machine learning work?

Supervised machine learning requires the <u>data scientist</u> to train the algorithm with both labeled inputs and desired outputs. Supervised learning algorithms are good for the following tasks:

- **Binary classification:** Dividing data into two categories.

- **Multi-class classification:** Choosing between more than two types of answers.

- **Regression modeling:** Predicting continuous values.

- **Ensembling:** Combining the predictions of multiple machine learning models to produce an accurate prediction.

e) How does unsupervised machine learning work?

Unsupervised machine learning algorithms do not require data to be labeled. They sift through unlabeled data to look for patterns that can be used to group data points into subsets. Most types of deep learning, including neural networks, are unsupervised algorithms. Unsupervised learning algorithms are good for the following tasks:

- **Clustering:** Splitting the dataset into groups based on similarity.

- **Anomaly detection:** Identifying unusual data points in a data set.

- **Association mining:** Identifying sets of items in a data set that frequently occur together.

- **Dimensionality reduction:** Reducing the number of variables in a data set.

f) How does semi-supervised learning work?

Semi-supervised learning works by data scientists feeding a small amount of labeled training data to an algorithm. From this, the algorithm learns the dimensions of the data set, which it can then apply to new, unlabeled data. The performance of algorithms typically improves when they train on labeled data sets. But labeling data can be time consuming and expensive. Semi-supervised learning strikes a middle ground between the performance of supervised learning and the efficiency of unsupervised learning. Some areas where semi-supervised learning is used include:

- **Machine translation:** Teaching algorithms to translate language based on less than a full dictionary of words.

- **Fraud detection:** Identifying cases of fraud when you only have a few positive examples.

- **Labelling data:** Algorithms trained on small data sets can learn to <u>apply data labels</u> to larger sets automatically.

g) How does reinforcement learning work?

Reinforcement learning works by <u>programming an algorithm</u> with a distinct goal and a prescribed set of rules for accomplishing that goal. Data scientists also program the algorithm to seek positive rewards -- which it receives when it performs an action that is beneficial toward the ultimate goal -- and avoid punishments -- which it receives when it performs an action that gets it farther away from its ultimate goal. Reinforcement learning is often used in areas such as:

- **Robotics:** Robots can learn to perform tasks the physical world using this technique.

- **Video gameplay:** Reinforcement learning has been used to teach bots to play a number of video games.

- **Resource management:** Given finite resources and a defined goal, reinforcement learning can help enterprises plan out how to allocate resources.

h) Who's using machine learning and what's it used for?

Today, machine learning is used in a wide range of applications. Perhaps one of the most well-known examples of machine learning in action is the <u>recommendation engine</u> that powers Facebook's news feed.

Facebook uses machine learning to personalize how each member's feed is delivered. If a member frequently stops to read a particular group's posts, the recommendation engine will start to show more of that group's activity earlier in the feed.

Behind the scenes, the engine is attempting to reinforce known patterns in the member's online behavior. Should the member change patterns and fail to read posts from that group in the coming weeks, the news feed will adjust accordingly.

In addition to recommendation engines, other uses for machine learning include the following:

- **Customer relationship management.** CRM software can use machine learning models to analyze email and prompt sales team members to respond to the most important messages first. More advanced systems can even recommend potentially effective responses.

- **Business intelligence.** BI and analytics vendors use machine learning in their software to identify potentially important data points, patterns of data points and anomalies.

- **Human resource information systems.** HRIS systems can use machine learning models to filter through applications and identify the best candidates for an open position.

- **Self-driving cars.** Machine learning algorithms can even make it possible for a semi-autonomous car to recognize a partially visible object and alert the driver.

- **Virtual assistants.** Smart assistants typically combine supervised and unsupervised machine learning models to interpret natural speech and supply context.

i) What are the advantages and disadvantages of machine learning?

Machine learning has seen use cases ranging from predicting customer behavior to forming the operating system for self-driving cars.

When it comes to advantages, machine learning can help enterprises understand their customers at a deeper level. By collecting customer data and correlating it with behaviors over time, machine learning algorithms can learn associations and help teams tailor product development and marketing initiatives to customer demand.

Some companies use machine learning as a primary driver in their business models. Uber, for example, uses algorithms to match drivers with riders. Google uses machine learning to surface the ride advertisements in searches.

But machine learning comes with disadvantages. First and foremost, it can be expensive. Machine learning projects are typically driven by data scientists, who command high salaries. These projects also require software infrastructure that can be expensive.

There is also the problem of machine learning bias. Algorithms trained on data sets that exclude certain populations or contain errors can lead to inaccurate models of the world that, at best, fail and, at worst, are discriminatory. When an enterprise bases core business processes on biased models it can run into regulatory and reputational harm.

j) How to choose the right machine learning model

The process of choosing the right machine learning model to solve a problem can be time consuming if not approached strategically.

Step 1: Align the problem with potential data inputs that should be considered for the solution. This step requires help from data scientists and experts who have a deep understanding of the problem.

Step 2: Collect data, format it and label the data if necessary. This step is typically led by data scientists, with help from data wranglers.

Step 3: Chose which algorithm(s) to use and test to see how well they perform. This step is usually carried out by data scientists.

Step 4: Continue to fine tune outputs until they reach an acceptable level of accuracy. This step is usually carried out by data scientists with feedback from experts who have a deep understanding of the problem.

k) Importance of human interpretable machine learning

Explaining how a specific ML model works can be challenging when the model is complex. There are some vertical industries where data scientists have to use simple machine learning models because it's important for the business to explain how every decision was made. This is especially true in industries with heavy compliance burdens such as banking and insurance.

Complex models can produce accurate predictions, but explaining to a lay person how an output was determined can be difficult.

l) What is the future of machine learning?

While machine learning algorithms have been around for decades, they've attained new popularity as artificial intelligence has grown in prominence. Deep learning models, in particular, power today's most advanced AI applications.

Machine learning platforms are among enterprise technology's most competitive realms, with most major vendors, including Amazon, Google, Microsoft, IBM and others, racing to sign customers up for platform services that cover the spectrum of machine learning activities, including data collection, data preparation, data classification, model building, training and application deployment.

As machine learning continues to increase in importance to business operations and AI becomes more practical in enterprise settings, the machine learning platform wars will only intensify.

Continued research into deep learning and AI is increasingly focused on developing more general applications. Today's AI models require extensive training in order to produce an algorithm that is highly optimized to perform one task. But some researchers are exploring ways to make models more flexible and are seeking techniques that allow a machine to apply context learned from one task to future, different tasks.

4.3. Implementation

a) Libraries used

Open CV

OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features.

The first OpenCV version was 1.0. OpenCV is released under a BSD license and hence it's free for both academic and commercial use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. When OpenCV was designed the main focus was real-time applications for computational efficiency. All things are written in optimized C/C++ to take advantage of multi-core processing.

TensorFlow

TensorFlow is an end-to-end open-source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries, and community resources that lets researchers push the state-of-the-art in ML and developers easily build and deploy ML-powered applications.

TensorFlow was originally developed by researchers and engineers working on the Google Brain team within Google's Machine Intelligence Research organization to conduct machine learning and deep neural networks research. The system is general enough to be applicable in a wide variety of other domains, as well.

TensorFlow provides stable Python and C++ APIs, as well as non-guaranteed backward compatible API for other languages.

NumPy

NumPy is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, fourier transform, and matrices.

NumPy was created in 2005 by Travis Oliphant. It is an open-source project and you can use it freely. NumPy stands for Numerical Python.

NumPy arrays are stored at one continuous place in memory unlike lists, so processes can access and manipulate them very efficiently. This behavior is called locality of reference in computer science.

This is the main reason why NumPy is faster than lists. Also it is optimized to work with latest CPU architectures.

Face Recognition

Recognize and manipulate faces from Python or from the command line with the world's simplest face recognition library. Built using dlib's state-of-the-art face recognition built with deep learning. The model has an accuracy of 99.38% on the Labeled Faces in the Wild benchmark.

This also provides a simple face recognition command line tool that lets you do face recognition on a folder of images from the command line!
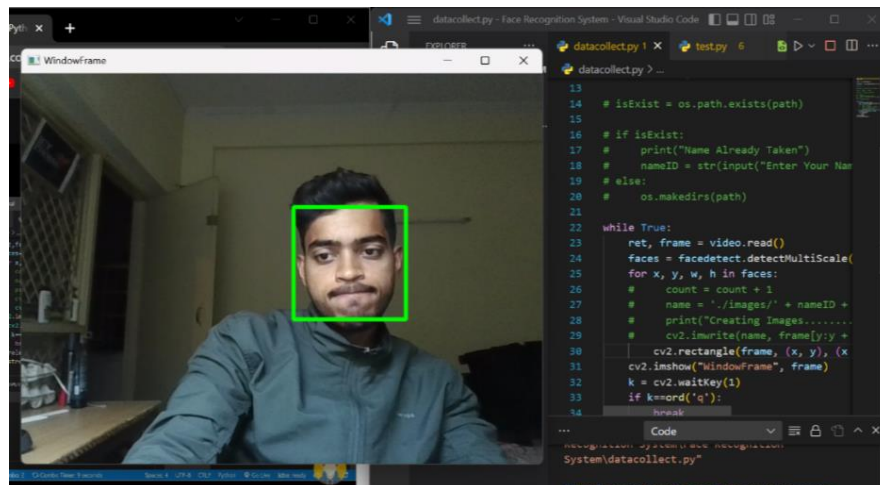
b) Input and Model

Application used for training the data: Teachable Machine
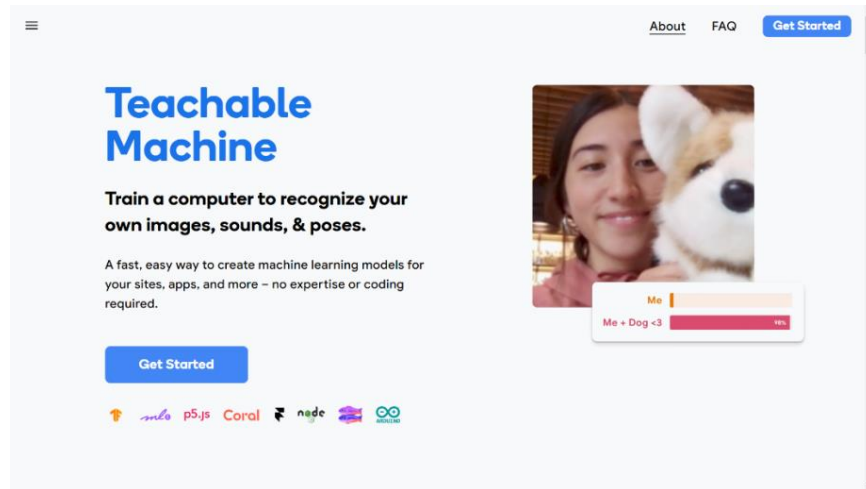
Fig 4.2 Training ML Model

Step 1: Detecting and Capturing the data

In the terminal run *python datacollect.py* for collecting the data

Fig 4.3 Capturing the Data

Step 2: Importing and Cleaning data to the Teachable Machine
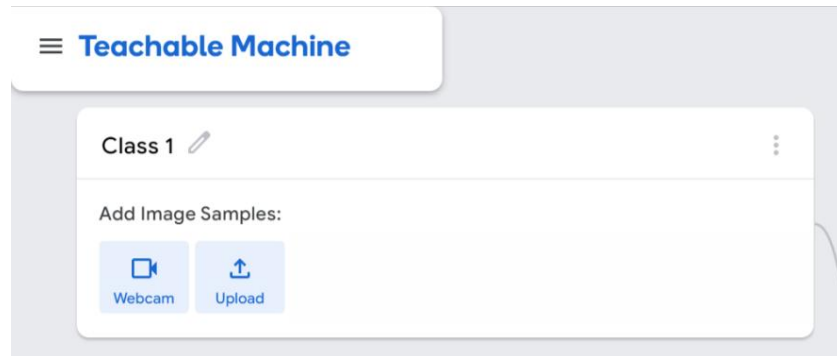
Step 3: Creating and Training the Model
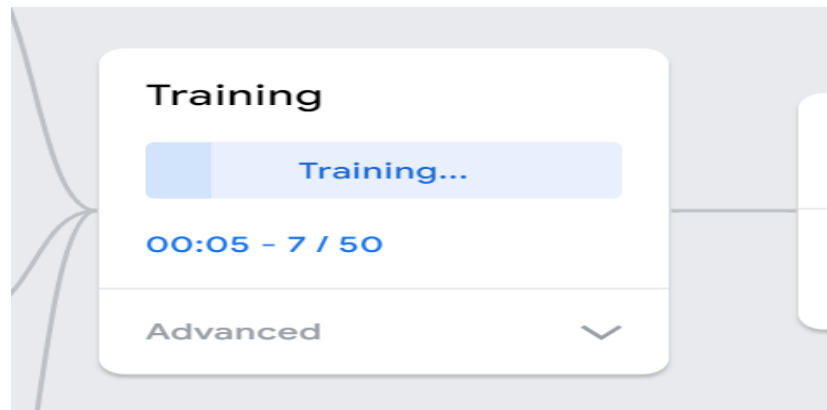
Step 4: Make predictions and evaluate
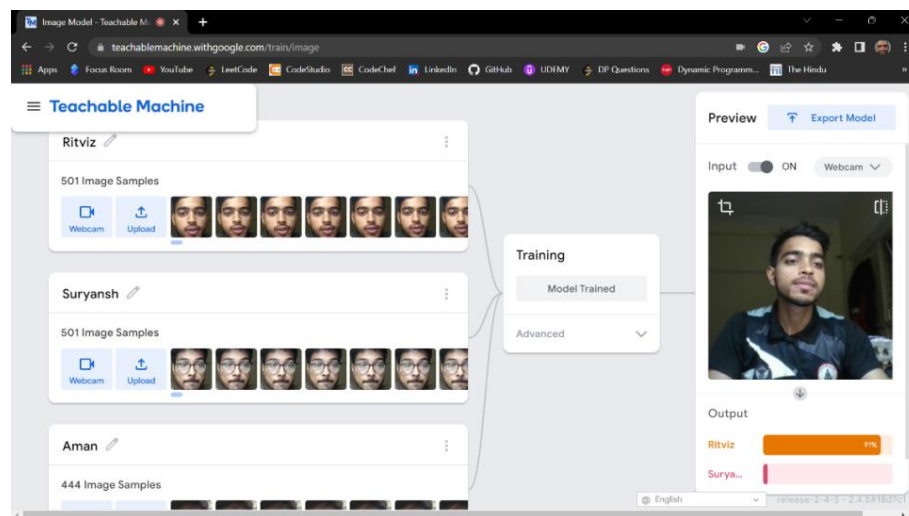

Fig 4.4 Sample Data

5. Publishing Web Application

Netlify is a platform for hosting websites. It is easy to host sites on Netlify as you don't need to configure it manually – and best of all, it's free. If you haven't signed up for an account, now is a good time to do so.

Here's the step-by-step process of publishing your website on Netlify:

Step 1: Add Your New Site

Create a New Site from GIT. Remember to have created your repository, once it is done you need to follow 3 major steps.
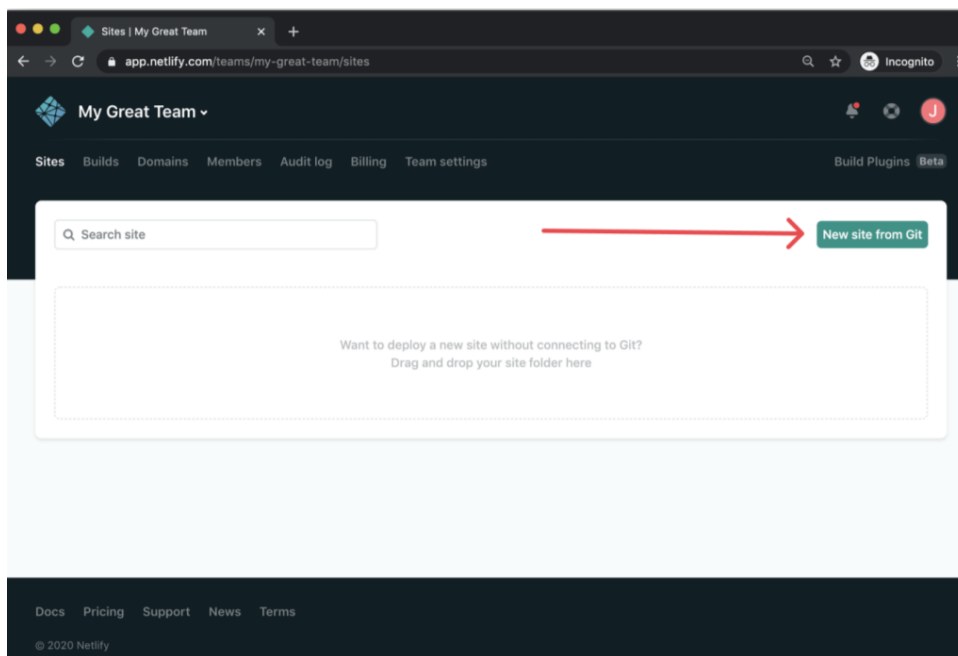
Fig 5.1: New site from git

Step 2: Link to Your GitHub (or supported version-control tool of choice)

Connect to Git provider. Now choose a Git host provider where you have created your repository. I will be choosing BitBucket since I have my project and repository created in Bitbucket.
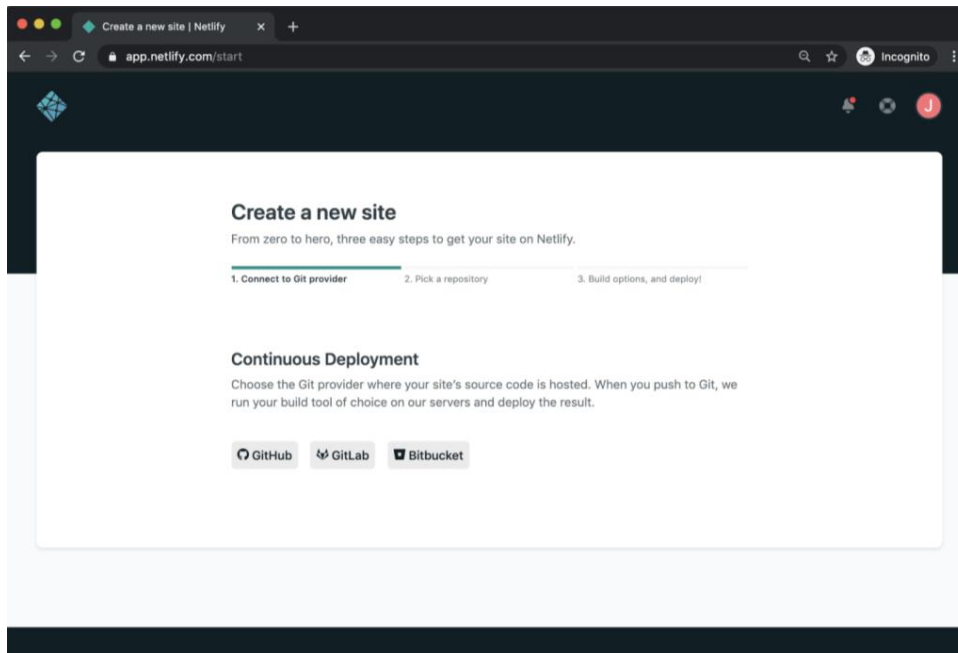
Fig 5.2: Create a new site
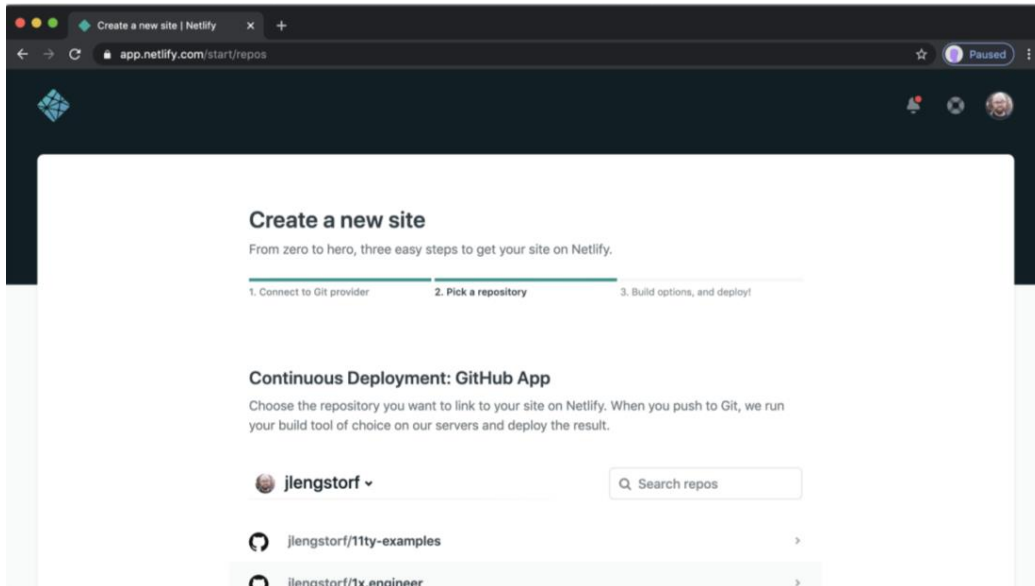
Step 3: Authorize Netlify

It's time to allow Netlify and GitHub to talk to each other. Clicking the Authorize Application button will do just that.
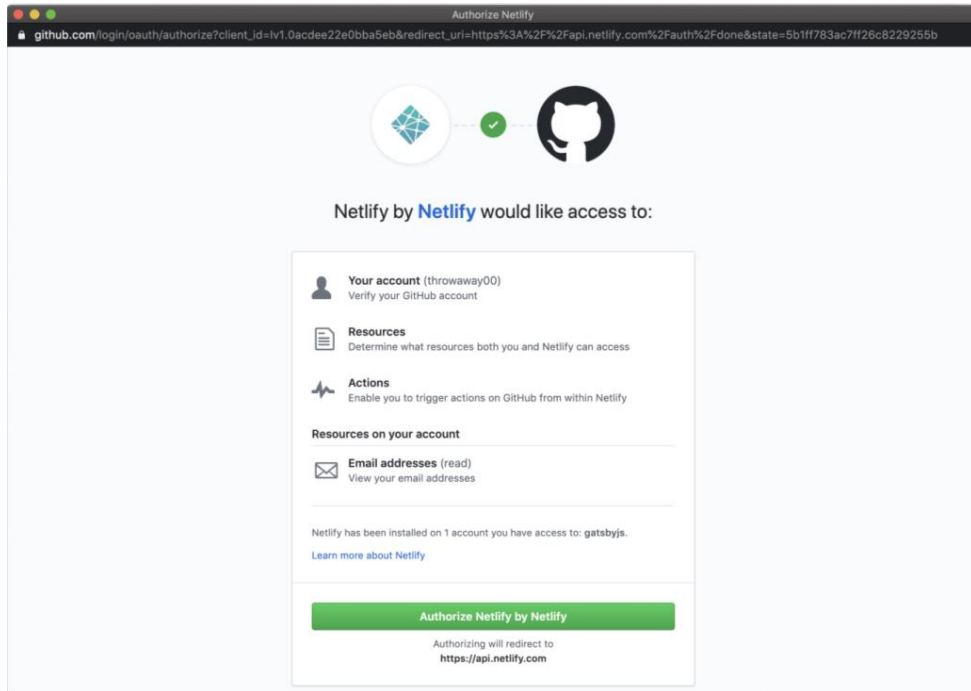
**Fig 5.3 Authorize Netlify**

Step 4: Select Your Repo

Pick a repository. Once you have authorized with the Git host provider, you now need to Pick a repository that you have created.

Fig 5.4 Select Repo

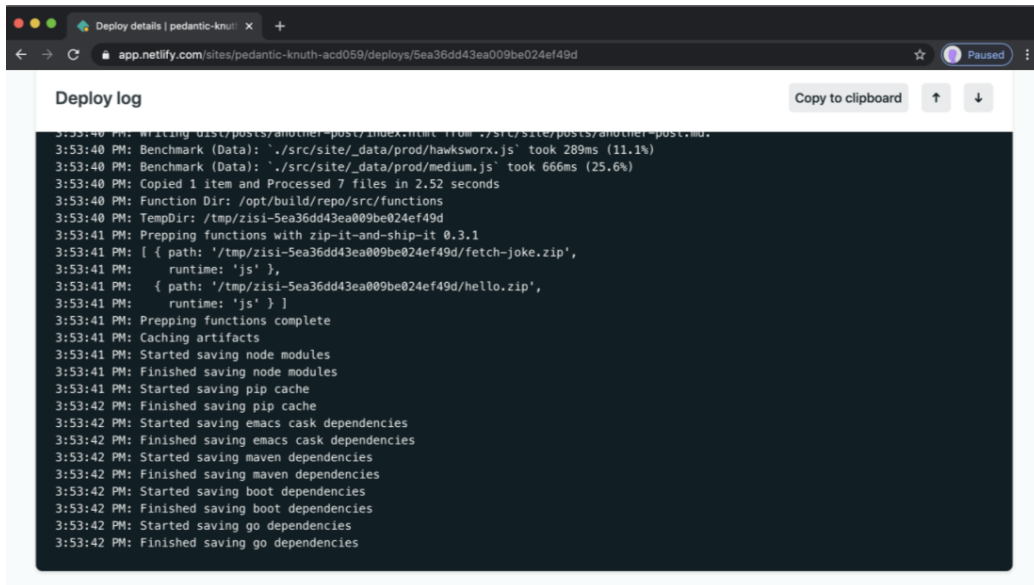**Step 5: Configure Your Settings**

Once you have picked your repository, deploy your site. The base directory will be main by default. You just have to click on the Deploy Site for now.
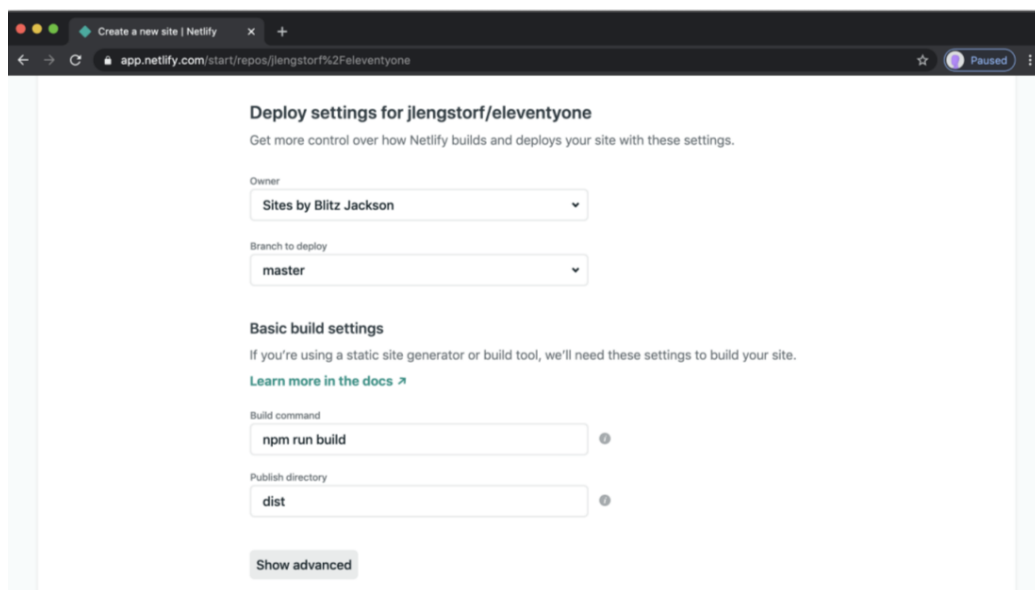
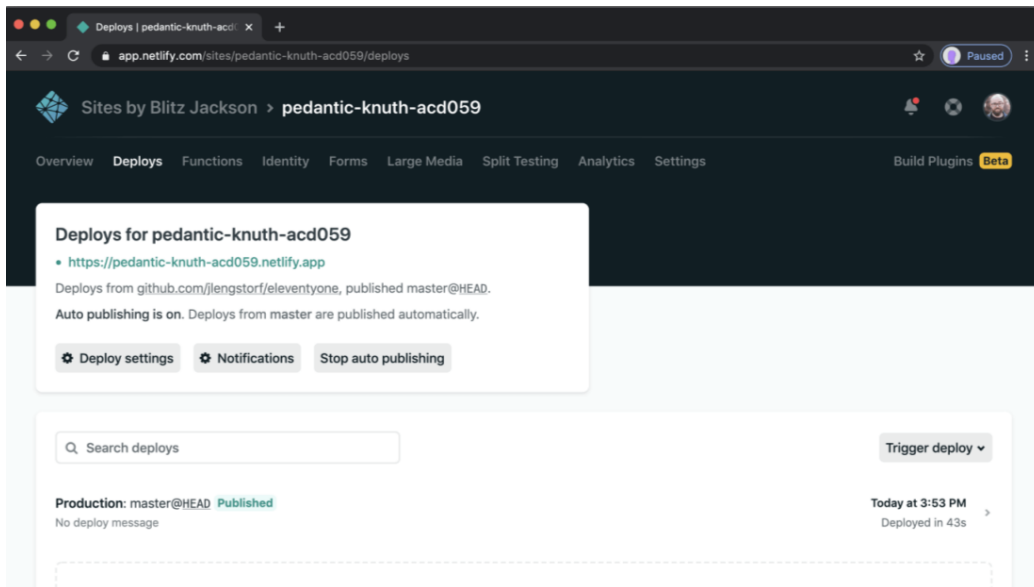**Fig 5.5 Configure Build Setting**

Step 6: Build Your Site

Now it's time to sit back and relax. You did your part; let Netlify take care of the rest. It'll only take a minute.
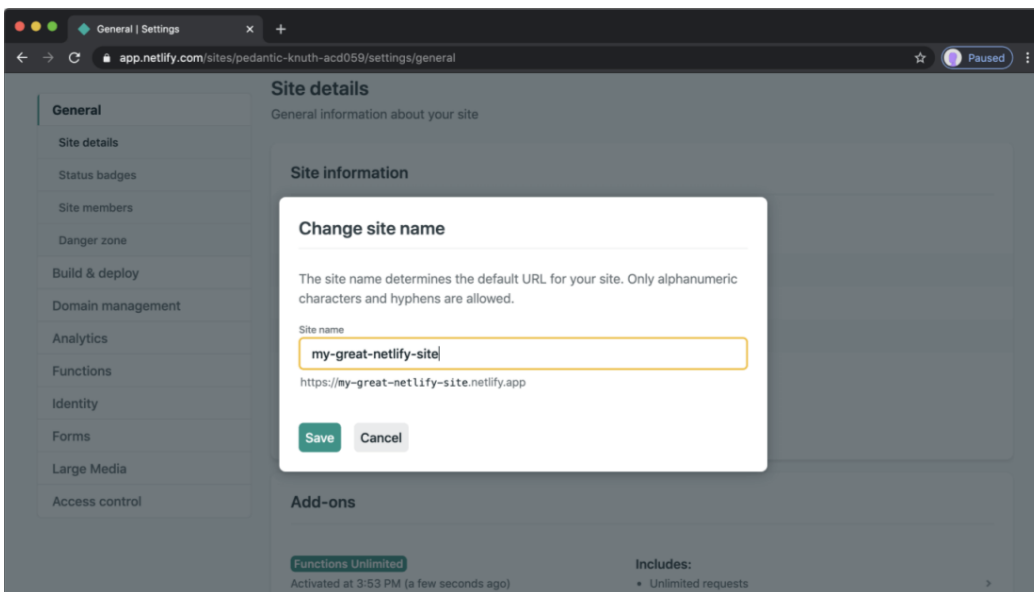

Fig 5.6 Build site

Step 7: All Done

Wait for a few seconds and you will get a successful link which is in green color. Netlify will generate a random name for your site, with its own domain i.e., netlify.app

Fig 5.7 Deployed

Step 8: Change Site Name

Now that your site is successfully deployed you can edit the site name, Go to domain settings, select options, and edit the site name. Enter the site name and save.

Fig 5.8 Change site name

6. References

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