Git and GitHub: A Beginner's Guide with Real-World Use Cases and Commands

Introduction to Git and GitHub

What is Git?

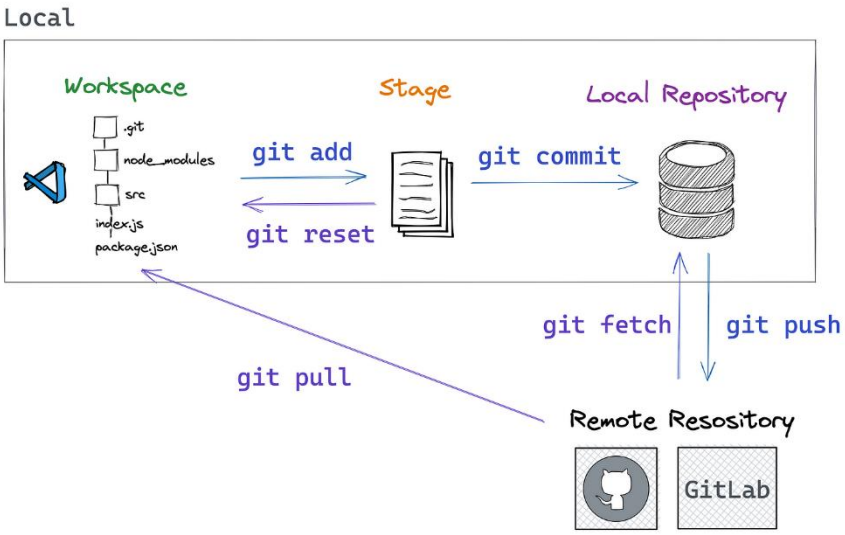
Git is a distributed version control system (VCS) that allows multiple people to work on a project simultaneously without overriding each other's changes. It helps in tracking changes to files and allows you to revert to previous versions if needed.

Imagine you're writing a big essay. Git is like a notebook where you save different versions of your essay. If you make a mistake, you can go back to an earlier version instead of starting over. It also lets multiple people edit the essay without erasing each other's work.

What is GitHub?

GitHub is a cloud-based platform that provides hosting for Git repositories. It allows teams to collaborate, review code, and manage projects efficiently.

GitHub is like Google Drive for your code. It stores your Git projects online so you can access them from anywhere, share them with others, and work together on them easily.



Setting Up Git and GitHub from Scratch

If you're new to Git and GitHub, follow this step-by-step guide to set everything up on your system.

Step 1: Install Git

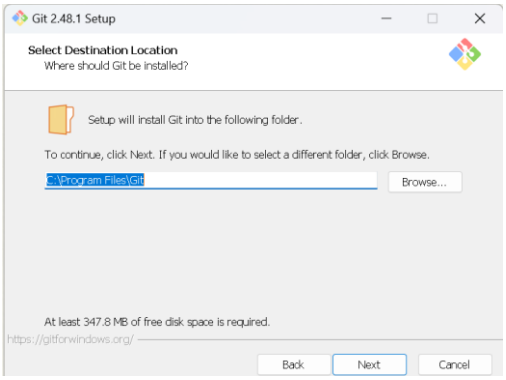
Git needs to be installed on your local machine to use it.

For Windows

1. Download Git for Windows from git-scm.com.

Click 64bit Git for Windows Setup (Standard Installer)

2. Choose Windows and click Download.
3. Install it with default settings.



Open exe file➔ click next (use default settings)

Once installed successfully, Open PowerShell with Administrator rights

To verify the installation, run:

git --version

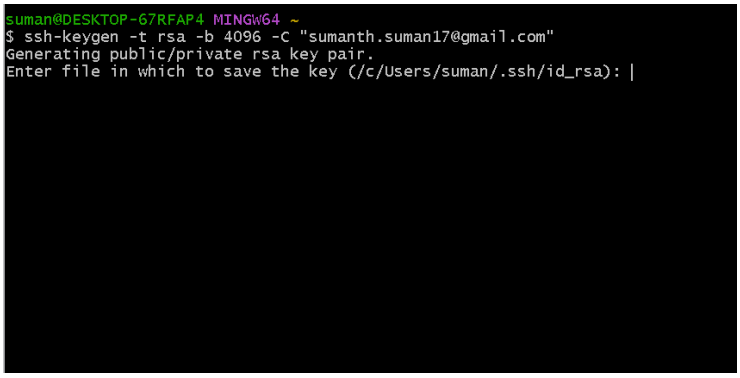
Step 2: Create a GitHub Account

1. Go to GitHub.
2. Click **Sign Up**.
3. Enter your email, create a username, and set a password.
4. Verify your email.

On Windows

1. Open Git Bash and run:

ssh-keygen -t rsa -b 4096 -C your-email@example.com



Click Enter➔ Yes

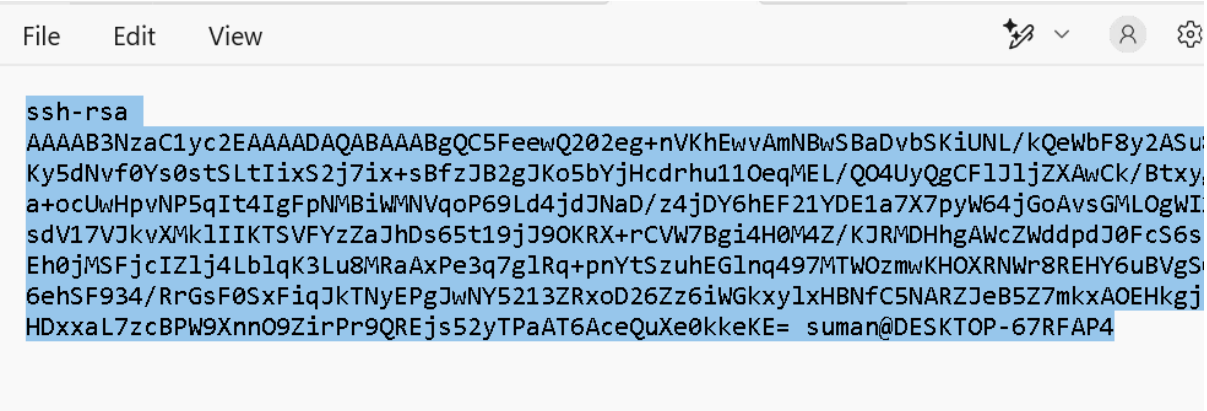
2. Open the key file in Notepad:

   c:/users/sumanth/.ssh/id_rsa.pub

```
suman@DESKTOP-67RFAP4 MINGW64 ~
$ ssh-keygen -t rsa -b 4096 -C "sumanth.suman17@gmail.com"
Generating public/private rsa key pair.
Enter file in which to save the key (/c/Users/suman/.ssh/id_rsa):
/c/Users/suman/.ssh/id_rsa already exists.
Overwrite (y/n)? n
```

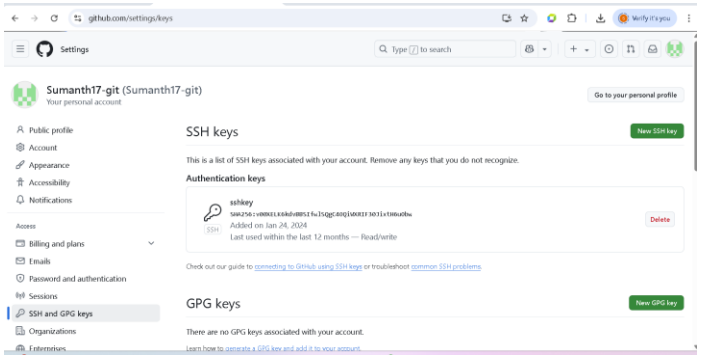
c:/users/sumanth/.ssh/id_rsa.pub

3. Open this file and copy the key.



Add the SSH Key to GitHub

1. Go to **GitHub > Settings > SSH and GPG keys**.



2. Click **New SSH Key**.
3. Paste the copied key and save it.

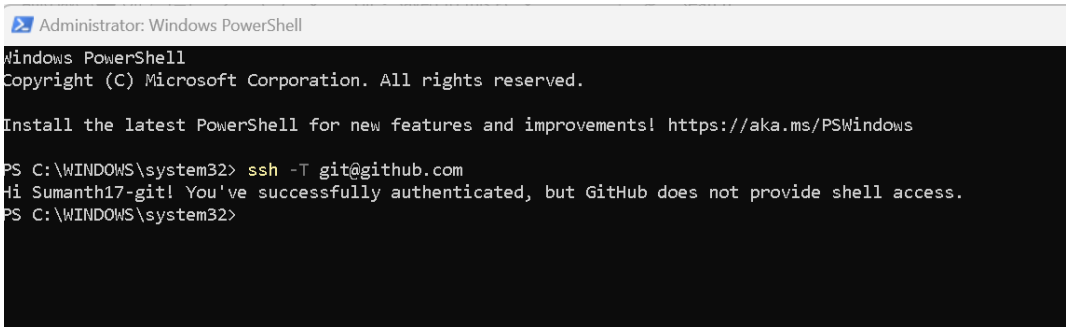
Test SSH Connection

Run:

ssh -T git@github.com

If successful, you'll see:

Hi username! You've successfully authenticated, but GitHub does not provide shell access.



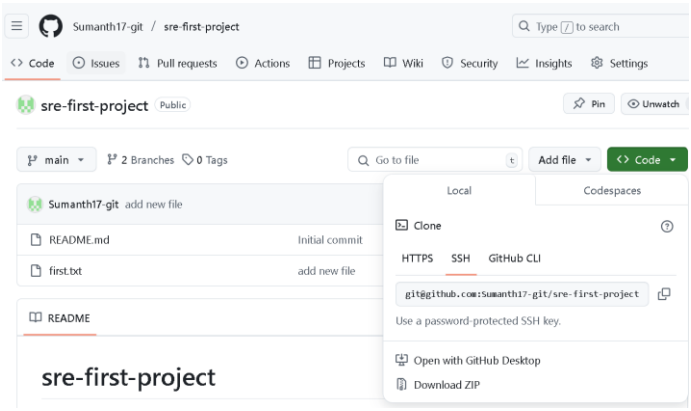
Step 3: Create a New Repository on GitHub

1. Go to GitHub and click **New Repository**.
2. Give it a name (e.g., my-first-repo).
3. Choose **Public** or **Private**.
4. Click **Create Repository**.

Step 4: Connect Git with GitHub

Clone the Repository (Copy it Locally)

git clone git@github.com:Sumanth17-git/sre-first-project.git



cd my-first-webservice.

3. GitHub Permission Issues

If SSH works but you still can't push, check:

git remote -v

If the URL starts with https://, update it to SSH:

git remote set-url origin git@github.com:Sumanth17-git/sre-first-project.git

git config --global user.name "Your Name"

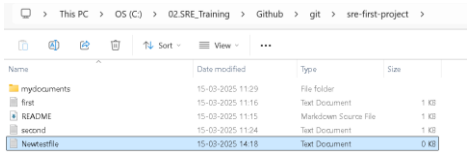
git config --global user.email "your-email@example.com"

If SSH keeps failing, switch to HTTPS:

git remote set-url origin https://github.com/Sumanth17-git/sre-first-project.git

Step 5: Make Your First Commit

1. Create a new file: Newtestfile.txt



After you added any changes in the repository ,run

git status

this would give you list of files have updated/created

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git status
On branch main
Your branch is up to date with 'origin/main'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        Newfile.pub
        testing.txt

nothing added to commit but untracked files present (use "git add" to track)
```

2. Add it to Git:

git add Newtestfile.txt

or

git add -A or git add .

3. Commit the changes:

git commit -a -m "updated the changes"

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git status
On branch main
Your branch is up to date with 'origin/main'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        Newfile.pub
        testing.txt

nothing added to commit but untracked files present (use "git add" to track)
PS C:\02.SRE_Training\Github\git\sre-first-project> git add -A
PS C:\02.SRE_Training\Github\git\sre-first-project> git add .
PS C:\02.SRE_Training\Github\git\sre-first-project> git commit -a -m "updated the changes"
[main 107ca26] updated the changes
 2 files changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 Newfile.pub
 create mode 100644 testing.txt
PS C:\02.SRE_Training\Github\git\sre-first-project>
```

7. Viewing Commit History

git log

 Purpose: Displays commit history.

 Real-world Use Case: Checking who made what changes and when

To see a summary:

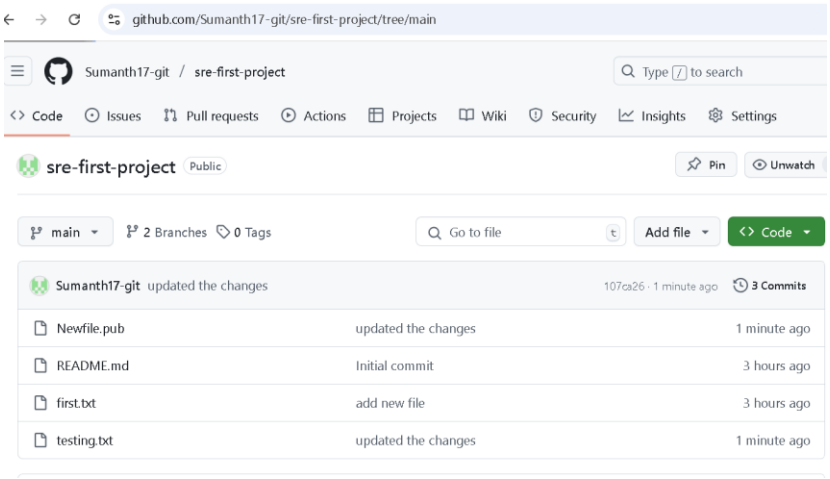
git log –oneline

4. Push the changes to GitHub:

git push origin main

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git push origin main
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 8 threads
Compressing objects: 100% (3/3), done.
Writing objects: 100% (4/4), 4.83 KiB | 4.83 MiB/s, done.
Total 4 (delta 0), reused 0 (delta 0), pack-reused 0 (from 0)
To https://github.com/Sumanth17-git/sre-first-project.git
   2965674..107ca26  main -> main
```

The changes are successfully uploaded into github repository. Let's verify in GitHub, as you can see we have successfully pushed the changes to GitHub(i.e. Cloud storage) for future use.



Pulling Changes from GitHub

git pull origin <branch_name>

- Purpose: Updates the local repository with the latest changes.
- Real-world Use Case: A developer ensures they have the latest code before making changes.

Now we will discuss what is branching in Git

🔹 What is Branching in GitHub?

Branching in GitHub (and Git) is a feature that allows you to create independent versions of your code to work on new features, bug fixes, or experiments without affecting the main project.

Think of **branches** like separate workspaces where you can make changes safely and later merge them back into the main branch

🔹 Why Use Branching?

✅ Work on **new features** without disturbing the main code
✅ Fix **bugs** without affecting ongoing development
✅ Collaborate with a team by working on separate branches
✅ Experiment safely and **merge only when ready**

Hands-On: GitHub Branching Example

Check Existing Branches

git branch

 Shows all **local** branches.

 The current branch is marked with *.

To see remote branches:

git branch -r

2.Create a New Branch

git branch sre-change

- This creates a new branch called feature-branch, but you're still on the current branch.

To **create and switch** to it immediately:

git checkout -b sre-change

3.Switch to a Different Branch

git checkout sre-change

OR in modern Git versions (recommended):

git switch sre-change

4.Make changes in Branch and commit it in branch.

git add -A

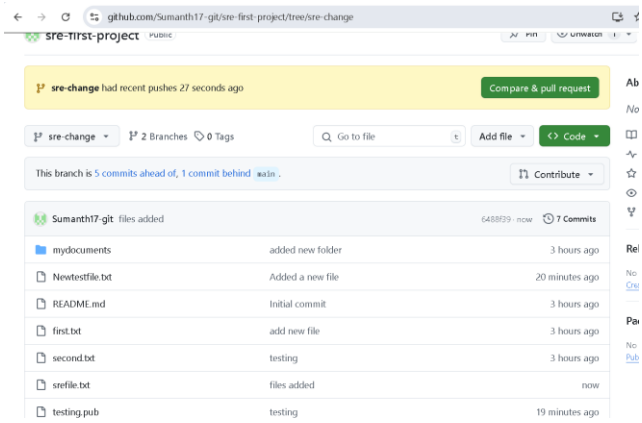
git commit -a -m "committed the changes"

4.Push the Branch to GitHub

After making changes, push your branch to GitHub:

git push origin sre-change

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git push origin sre-change
Enumerating objects: 9, done.
Counting objects: 100% (9/9), done.
Delta compression using up to 8 threads
Compressing objects: 100% (7/7), done.
Writing objects: 100% (8/8), 5.25 KiB | 2.62 MiB/s, done.
Total 8 (delta 2), reused 0 (delta 0), pack-reused 0 (from 0)
remote: Resolving deltas: 100% (2/2), done.
To https://github.com/Sumanth17-git/sre-first-project.git
   9796cdf..6488f39  sre-change -> sre-change
```



Now I have made changes only branch **sre-change** and these changes are not merged into **main** branch.

To Merge the changes from **sre-change** branch to **main** branch

git merge <branch_name>

- Purpose: Combines changes from one branch into another.
- Real-world Use Case: After completing a feature, it is merged into main.

Example:

Switch to main branch and merge the sre-change

git checkout main

git merge sre-change

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git checkout main
Switched to branch 'main'
Your branch is up to date with 'origin/main'.
PS C:\02.SRE_Training\Github\git\sre-first-project> git merge sre-change
Merge made by the 'ort' strategy.
 Newtestfile.txt                                |  0
 .../dt-account-management-users-3-9-2025.csv   | 44 ++++++++++++++++++++
 second.txt                                     |  1 +
 srefile.txt                                    |  0
 testing.pub                                    | Bin 0 -> 59904 bytes
 5 files changed, 45 insertions(+)
 create mode 100644 Newtestfile.txt
 create mode 100644 mydocuments/dt-account-management-users-3-9-2025.csv
 create mode 100644 second.txt
 create mode 100644 srefile.txt
 create mode 100644 testing.pub
```

It will open the vim editor like below

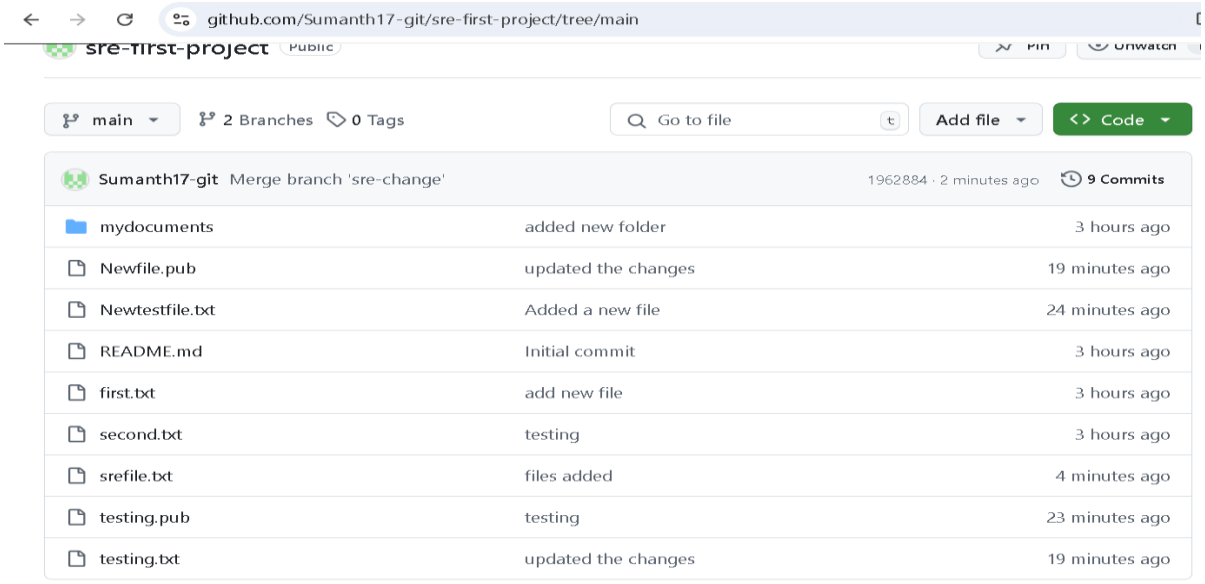
Save and exit using below command

wq!

And then push the changes to main branch

git push origin main

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git push origin main
Enumerating objects: 4, done.
Counting objects: 100% (4/4), done.
Delta compression using up to 8 threads
Compressing objects: 100% (2/2), done.
Writing objects: 100% (2/2), 323 bytes | 323.00 KiB/s, done.
Total 2 (delta 1), reused 0 (delta 0), pack-reused 0 (from 0)
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To https://github.com/Sumanth17-git/sre-first-project.git
   107ca26..1962884  main -> main
PS C:\02.SRE_Training\Github\git\sre-first-project>
```



To Delete the branch after merging into main branch

git branch

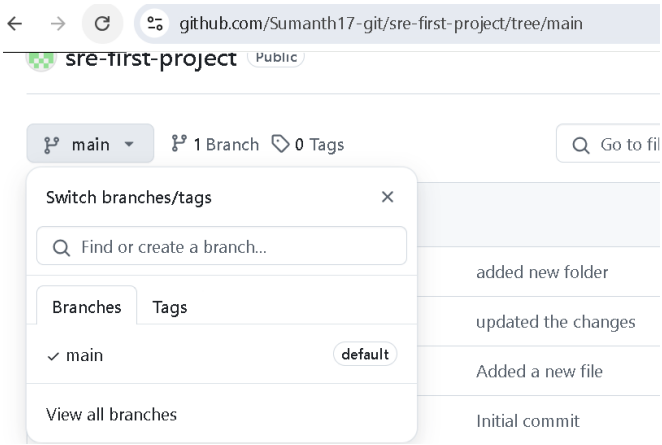
git branch -D sre-change

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git branch
* main
  sre-change
PS C:\02.SRE_Training\Github\git\sre-first-project> git branch -D sre-change
Deleted branch sre-change (was 6488f39).
PS C:\02.SRE_Training\Github\git\sre-first-project>
```

To delete the branch on GitHub UI

git push origin –delete sre-change

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git push origin --delete sre-change
To https://github.com/Sumanth17-git/sre-first-project.git
 - [deleted]         sre-change
PS C:\02.SRE_Training\Github\git\sre-first-project>
```



Troubleshooting

To Check the commit history

git log –oneline

To check the configuration

git config –list

To Setup the configuration.

git config --global user.name "Your Name"

git config --global user.email your-email@example.com

GitHub Permission Issues

If SSH works but you still can't push, check:

git remote -v

If the URL starts with https://, update it to SSH:

git remote set-url origin git@github.com:your-username/repository-name.git

If SSH keeps failing, switch to HTTPS:

git remote set-url origin https://github.com/your-username/repository-name.git

---

GitHub/SRE Use Case – Interview Point of View

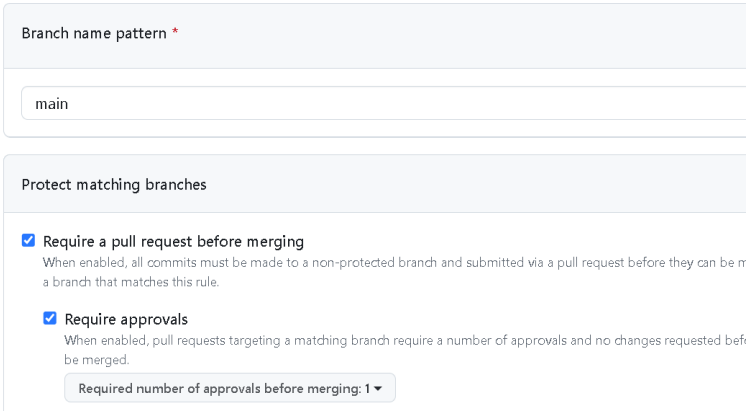
Scenario 1: How do you apply the Protecting the Main Branch in GitHub

Use Case: You want to **prevent accidental pushes** to main and **enforce code reviews**.

Step 1: Enable Branch Protection

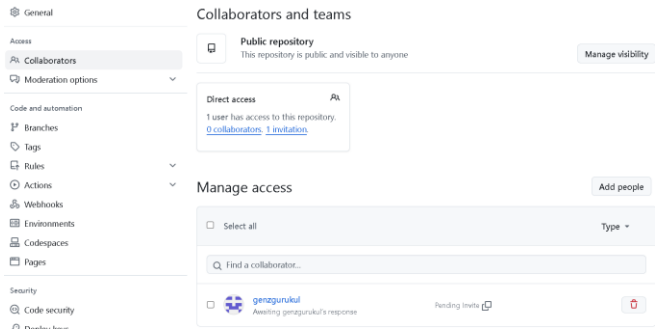
1. Go to **GitHub > Your Repository > Settings**.
2. Click on **Branches** → **Add branch protection rule**.
3. Set:

- **Require pull request reviews before merging** ✅
- **Require status checks before merging** ✅
- **Restrict who can push to this branch** ✅



How do you create the pull request from GitHub UI

Firstly go the Repository ➔ Settings ➔ Collaborators ➔Add your friend/teammate Github id. So he will approve the change you make.

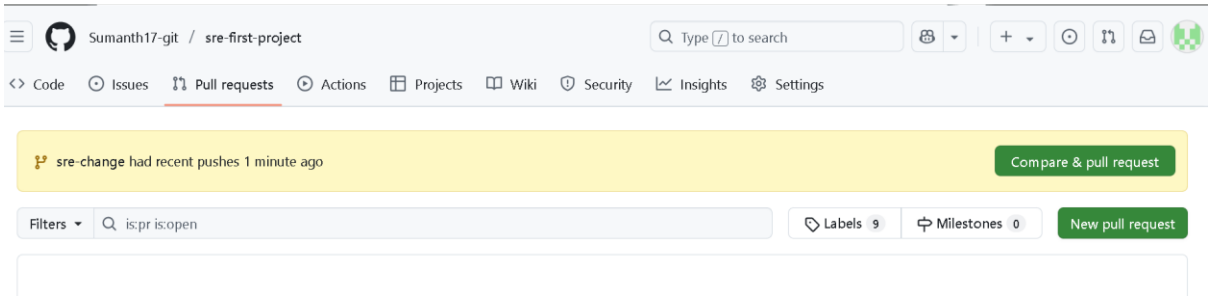


When you push any changes into branch.

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git branch
  main
* sre-change
PS C:\02.SRE_Training\Github\git\sre-first-project> git add -A
PS C:\02.SRE_Training\Github\git\sre-first-project> git commit -a -m "testing"
[sre-change f65aac9] testing
 1 file changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 sample file.txt
PS C:\02.SRE_Training\Github\git\sre-first-project> git push origin sre-change
Enumerating objects: 4, done.
Counting objects: 100% (4/4), done.
Delta compression using up to 8 threads
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 312 bytes | 156.00 KiB/s, done.
Total 3 (delta 0), reused 0 (delta 0), pack-reused 0 (from 0)
To https://github.com/Sumanth17-git/sre-first-project.git
   2965674..f65aac9  sre-change -> sre-change
```

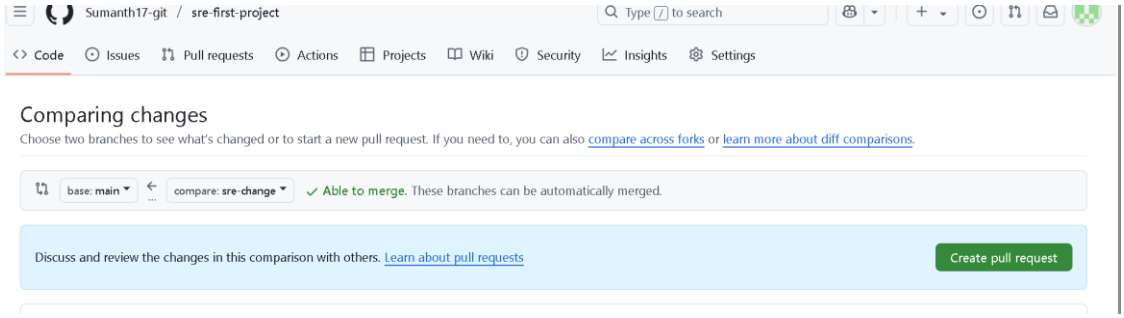
Now we need to merge this change into main branch. We need to create the pull request for this

Click Pull Requests ➔ New pull request ➔



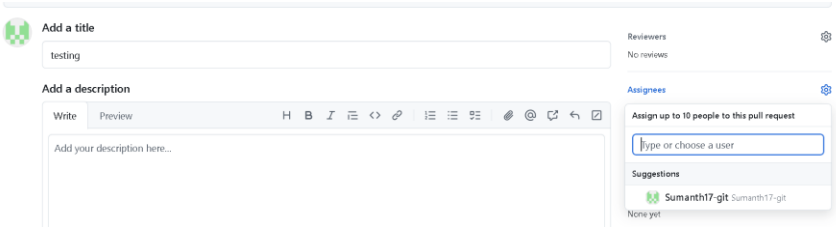
Choose base : main and compare : sre-change

As we are planning the merge the changes from sre-change branch to main branch

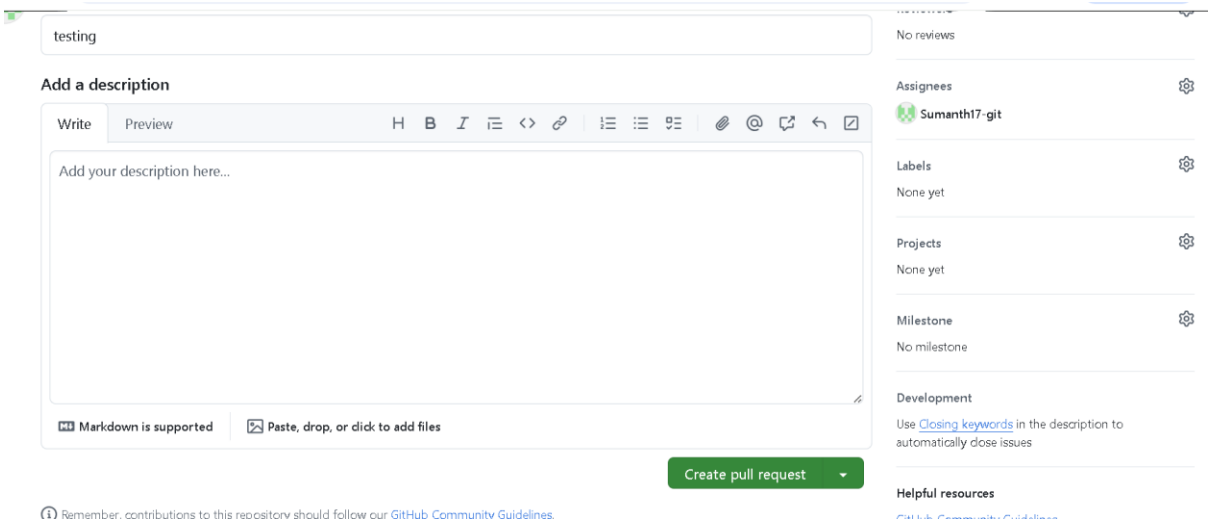


Click Create Pull request

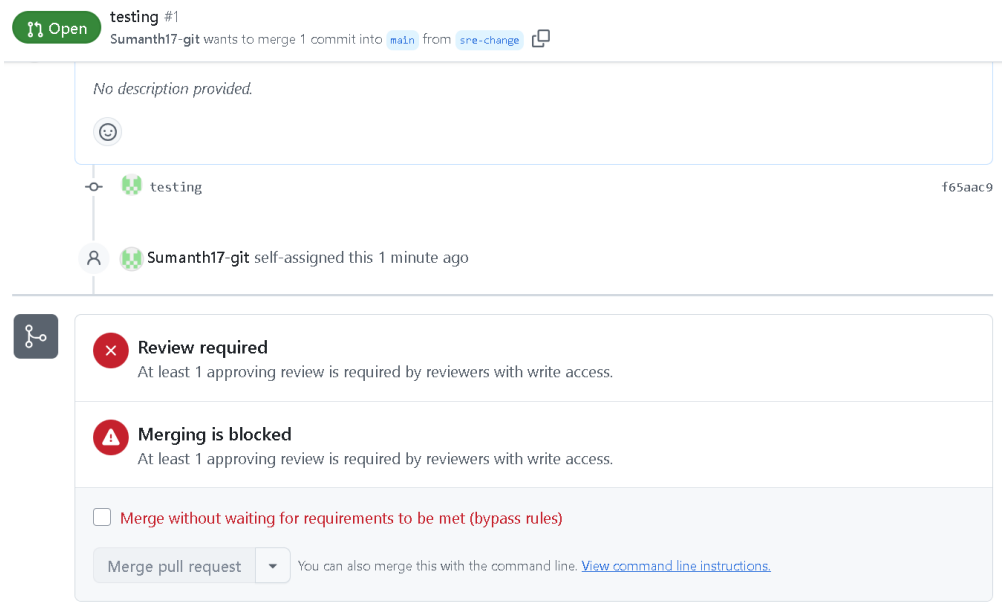
Add assignee and updated title and description



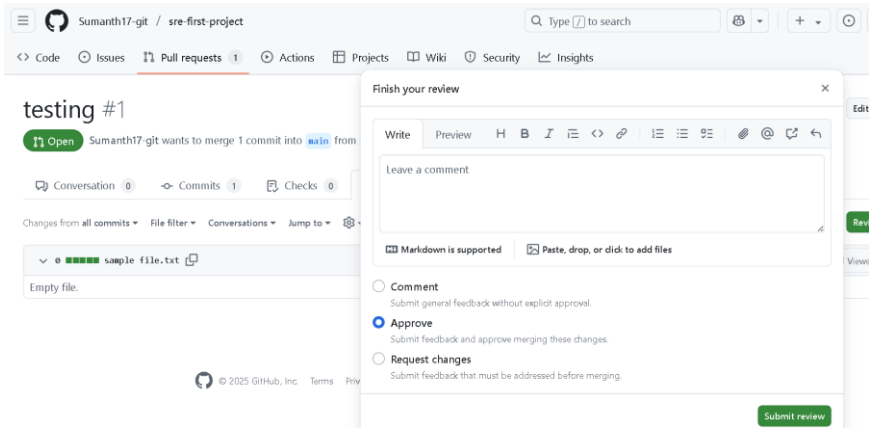
Click Create Pull Request



Now you can see , Review is required , so your team-mate/manager has to approve your changes.

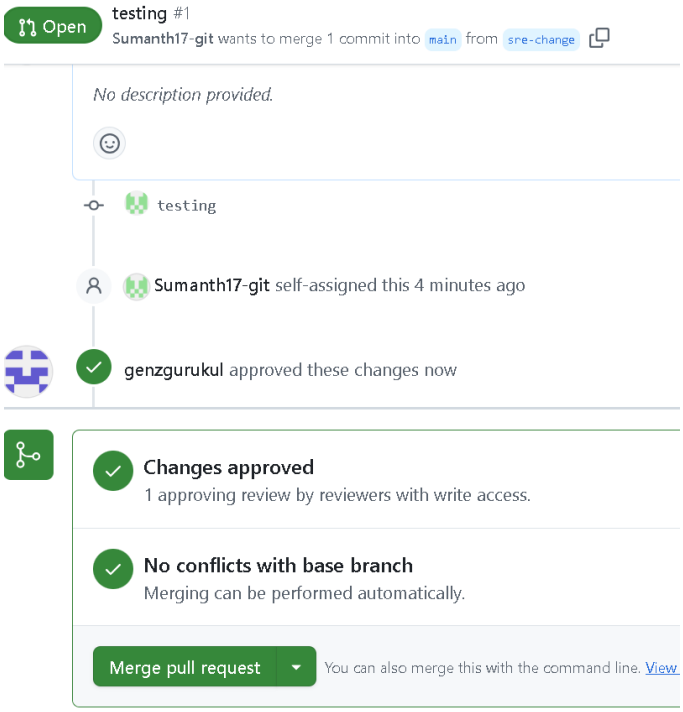


Now your manager will approve the change after review the changes.

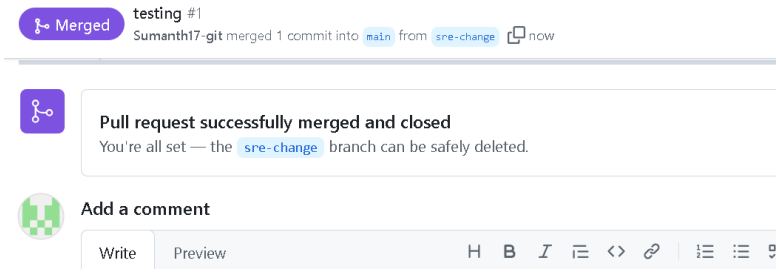


Click Submit Review .

Once your manager the Pull request , you can merge the changes into Main Branch , **Click Merge Pull Request and confirm the merge.**



Now your changes are successfully merged into Main Branch



Scenario 2: How do you Secure Authentication Using GitHub Personal Access Token (PAT)

Use Case: Instead of SSH, you want to use HTTPS authentication with **Personal Access Tokens**.

Step 1: Generate a GitHub Token

1. Go to **GitHub > Settings > Developer Settings > Personal Access Tokens**.
2. Click **Generate New Token**.
3. Select:
    - repo (Full control)
    - workflow (GitHub Actions)
4. Copy the **token**.

Step 2: Set Up Git to Use the Token

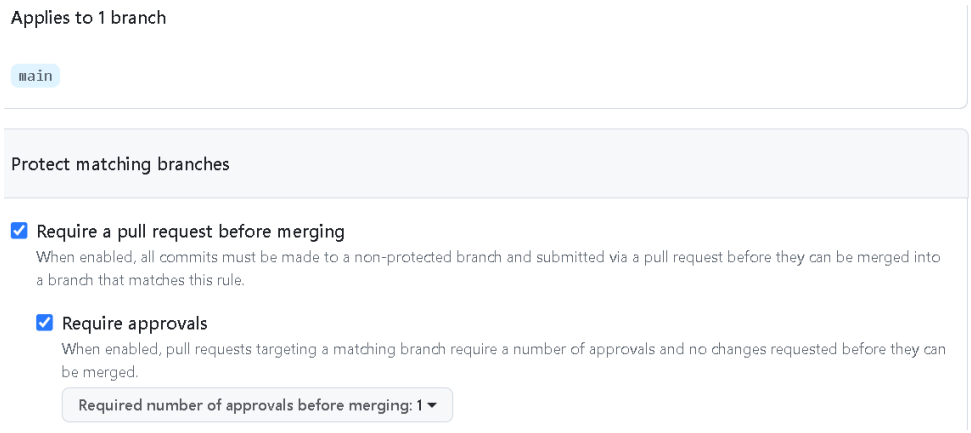
Replace your GitHub remote URL:

git remote set-url origin https://your-username@github.com/your-username/repository-name.git

Now, when pushing:

git push origin main

Git will **prompt for your token** instead of a password.



Now, **no one can push directly to main without review**.

Scenario 3 : How do you Bug Fixing in Production using GitHub process

Use Case: Urgent Bug Fix

A critical bug is found in production, affecting all users. The bug needs to be fixed immediately.

Step-by-Step Hands-On Example

Step 1: Create a Hotfix Branch

git checkout -b hotfix-urgent-bug

Step 2: Fix the Bug and Commit

Alice modifies the faulty code in checkout.js.

git add checkout.js

git commit -m "Fixed checkout bug in production"

Step 3: Push and Merge Directly into Production

Since this is an urgent fix, the team merges it into the main branch immediately.

git checkout main

git merge hotfix-urgent-bug

git push origin main

Scenario 4: Ho does Stashing Changes to Work on GitHub

Use Case: Switching Tasks Without Losing Work

For example Bob is working on a new feature, but an urgent bug needs fixing.

Step 1: Stash the Current Work

git stash

Step 2: Switch to the Bug Fix Branch

git checkout -b hotfix-payment-error

Bob fixes the bug, commits, and pushes.

Step 3: Restore the Stashed Work

git checkout feature-payment

git stash pop

Scenario 5: How to do Undoing Mistakes

Use Case: Reverting a Mistaken Commit

Bob accidentally committed sensitive credentials.

Step 1: Identify the Commit

git log --oneline

Step 2: Revert the Commit

git revert <commit_id>

This creates a new commit that undoes the previous commit.

Scenario 6: How to Resolve the Merge Conflicts

Use Case: Two Developers Modify the Same File

1. **Alice updates cart.js and pushes changes.**
2. **Bob also modifies cart.js in a different branch and tries to merge.**
3. **Conflict occurs.**

Step-by-Step Hands-On Example

Step 1: Bob Tries to Merge

git checkout main

git merge feature-cart-update

Error: Merge conflict in cart.js.

Step 2: Resolve the Conflict

Bob opens cart.js, manually fixes the conflicting lines, and saves the file.

Step 3: Add and Commit the Resolved File

git add cart.js

git commit -m "Resolved merge conflict in cart.js"

git push origin main

Scenario 7: Revert a Specific Commit (If You Want to Undo an Older Commit)

If you want to revert a specific commit, find the commit hash from git log --oneline and run:

git log –oneline

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git log --oneline
1962884 (HEAD -> main, origin/main, origin/HEAD) Merge branch 'sre-change'
6488f39 files added
107ca26 updated the changes
ca2fbb3 testing
e9fbed1 Added a new file
9796cdf added new folder
c00789c  testing
2965674 add new file
c19fd78 Initial commit
```

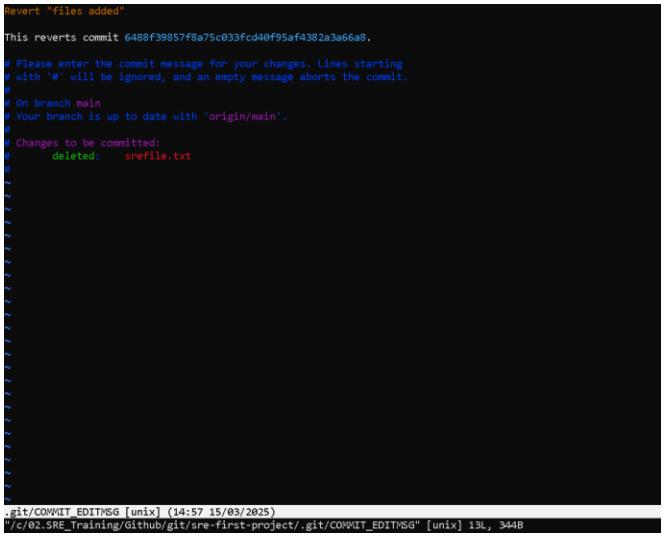
If you want to revert last change “files added” ,copy the commit id

git revert <commit-hash>

For example, if you want to revert commit 6488f39

git revert 6488f39

wq!




```
PS C:\02.SRE_Training\Github\git\sre-first-project> git log --oneline
1962884 (HEAD -> main, origin/main, origin/HEAD) Merge branch 'sre-change'
6488f39 files added
107ca26 updated the changes
ca2fbb3 testing
e9fbed1 Added a new file
9796cdf added new folder
c00789c  testing
2965674 add new file
c19fd78 Initial commit
PS C:\02.SRE_Training\Github\git\sre-first-project> ^C
PS C:\02.SRE_Training\Github\git\sre-first-project> git revert 6488f39
[main b825705] Revert "files added"
 1 file changed, 0 insertions(+), 0 deletions(-)
 delete mode 100644 srefile.txt
PS C:\02.SRE_Training\Github\git\sre-first-project>
```

This creates a new commit that undoes the faulty one, ensuring a rollback without rewriting history.

Pushing the Changes After Revert

If you used **reset** and already pushed your changes, you may need to force push:

git push origin master –force

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git push origin main
Enumerating objects: 3, done.
Counting objects: 100% (3/3), done.
Delta compression using up to 8 threads
Compressing objects: 100% (2/2), done.
Writing objects: 100% (2/2), 275 bytes | 275.00 KiB/s, done.
Total 2 (delta 1), reused 0 (delta 0), pack-reused 0 (from 0)
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To https://github.com/Sumanth17-git/sre-first-project.git
   1962884..b825705  main -> main
PS C:\02.SRE_Training\Github\git\sre-first-project> git push origin main --force
Everything up-to-date
```

Scenario 8.Scenario: A Developer Deleted a Critical Branch

Problem:

A teammate accidentally deleted a critical feature branch before merging.

Solution:

1. Find the deleted branch in Git reflog

git reflog

2. Restore the branch

git checkout -b recovered-branch <commit-hash>

3. Push it back to GitHub

git push origin recovered-branch

4. Inform the team and prevent accidental deletions by enabling branch protection rules.

Prevention Best Practices:

✅ Enable protected branches to prevent accidental deletions
✅ Set up branch policies in GitHub
✅ Use feature flags so incomplete features don’t need long-lived branches

```
PS C:\02.SRE_Training\Github\git\sre-first-project> git reflog
b825705 (HEAD -> main, origin/main, origin/HEAD) HEAD@{0}: revert: Revert "files added"
1962884 HEAD@{1}: merge sre-change: Merge made by the 'ort' strategy.
107ca26 HEAD@{2}: checkout: moving from sre-change to main
6488f39 HEAD@{3}: commit: files added
ca2fbb3 HEAD@{4}: checkout: moving from main to sre-change
107ca26 HEAD@{5}: commit: updated the changes
2965674 HEAD@{6}: checkout: moving from sre-change to main
ca2fbb3 HEAD@{7}: commit: testing
e9fbed1 HEAD@{8}: commit: Added a new file
9796cdf HEAD@{9}: commit: added new folder
c00789c HEAD@{10}: commit: testing
2965674 HEAD@{11}: checkout: moving from main to sre-change
2965674 HEAD@{12}: commit: add new file
c19fd78 HEAD@{13}: clone: from https://github.com/Sumanth17-git/sre-first-project.git
PS C:\02.SRE_Training\Github\git\sre-first-project> git checkout -b sre-change 2965674
Switched to a new branch 'sre-change'
PS C:\02.SRE_Training\Github\git\sre-first-project> git branch
  main
* sre-change
PS C:\02.SRE_Training\Github\git\sre-first-project> git push origin sre-change
Total 0 (delta 0), reused 0 (delta 0), pack-reused 0 (from 0)
remote:
remote: Create a pull request for 'sre-change' on GitHub by visiting:
remote:      https://github.com/Sumanth17-git/sre-first-project/pull/new/sre-change
remote:
To https://github.com/Sumanth17-git/sre-first-project.git
 * [new branch]      sre-change -> sre-change
PS C:\02.SRE_Training\Github\git\sre-first-project>
```