

# Cloud-based Project Management System for Engineering Students

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## **Abstract—**

*Project Management System is a very important tool in project planning. It not only plans the entire project timeline but also helps in analyzing errors and reducing the errors and mistakes that generally arise during making a good project. Good projects need proper planning and good tools that can help in reducing errors. Project management helps in testing the number of tasks and can help users to make good projects. The main objective of our paper is to identify the main characteristics we should look for while creating a website for a cloud-based project management system for engineering students. We will aim to address all the potential issues and keys with a proper explanation of how to use the discussed characteristics through the use of some solved examples to create a better user-interacted and user-specific cloud-based project management system application.*

**Keywords—***Analysis, Planning, Project Management, Testing, Tools, Users*

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## **I. INTRODUCTION**

The project management system is very much important in recent days as the number of projects developed recently is higher. The project management system is very important as also sizes of recent projects are more and hence it becomes very handy. Apart from that project management system should be trustworthy as it should properly store the codes and details.

Our Project management system helps users to plan future tasks and problems which can arise during managing a project. While making any project it is very important to plan things in hand, planning future tasks helps project makers to plan any problems which could arise in the future rather than facing them unplanned. A project management system also helps organizations let it be small or big. Every company has its projects divided into teams. Several teams have several members in it. The number of members can vary and it becomes hard for an organization to handle all project data. A project management system comes into the picture in

situations like this where codes tasks and objectives are predefined plus also acts as a storage for larger projects. Our Project management system mainly concerns students perusing undergrad. Options to add mentors and member details help colleges and organization to guide students in completing their projects. Options like adding batches enable students from different years to do the same projects. As mentioned earlier guides, mentors and the Head of the department can be added as well. The project management system helps us to plan risks and helps in managing budgets of projects as we can find risks and problems in hand and save money in later stages.

## II. LITERATURE REVIEW

We learned in this paper [1] how environments like GitHub provide social and collaborative features that are extremely beneficial to students' and teachers' educational experiences. The motivations, benefits, and challenges that GitHub brings to education are also discussed in this paper. GitHub has been adopted by the software development community as an essential platform for managing software projects. In the software industry, GitHub has increased efficiency. It aided in improving the way software developers work. It serves as a social gathering place for interested users, who are working on the same project as well as a traceable project repository. Educators have recently recognized the value of GitHub's collaborative features for managing and improving, if not completely transforming, the learning process. From the papers [6] and [7], the observing topics are that, whether it be a software-based industry or any other type of industry, it is always helpful if we manage projects properly. In terms of providing management information to effectively plan, monitor, and control material and labor resources, project management systems can be considered important tools in an industrial enterprise. Improving the ability to conceptualize, design, develop, and deliver information systems that meet customer requirements is a major challenge in project management systems [6].

Data security is very important in project management system. In this paper [10] we observe how security plays a vital role in designing application like GitHub. When you are adding your code and important file to a website there must be an assurance that the data would not be get deleted or would not be accessed by any other users other than you or your team. Data integrity and security is a very important step that must be taken in mind while designing a project management system. Now as the projects have increase in number, we observe that data and code stealing is happening so having a security over the data is very important. Adding security is important as well because if someone can access your personal files, they can also delete some of our data as well. Data is a very sensitive and it getting accessed by any other user is something adding security features to your website can avoid.

The main challenge with the project management system is that when working on a large number of projects, it will slow down your website or application. You have to look after the pull request to make it work. On our website, it's like when a project is assigned to a team, we have to look after the status update of tasks. From the papers [2] and [9], we learned that prioritizing pull requests (PRs) is one of the most difficult tasks for integrators in pull-based development. This is especially true for large open-source projects that receive hundreds of pull

requests every day. Indeed, manually managing these pull requests consumes time and resources, and can cause delays in the reaction (i.e., acceptance or response) to enhancements or bug fixes suggested by contributors in the codebase. The AR-Prioritizer (Acceptance and Response-based Prioritizer) approach has been suggested in this study. Furthermore, AR-Prioritizer has outperformed baseline models in terms of prioritizing the most likely to be accepted and respond to PRs with statistical significance.

As we know, social media plays a major role in today's lifestyle. Social media is frequently used by today's software developers, either as an add-on or as part of a variety of tools ranging from code editors and issue trackers to IDEs and web-based portals. In our system, we will look for the same solutions to the problems that are addressed in the paper [3], which are further mentioned. The benefits, risks, and limitations of using social media in software development. at the team, project, and community level. The paper suggests relevant questions around community involvement, project coordination, and management, as well as individual software development activities, guided by the implications of current tools and social media features. So we have to design it in such a way that it will be easily accessible by all the users. We have to keep human-machine interaction in mind while creating the PMS website.

As we all know, GitHub, the most popular social coding site, is increasingly being used to manage learning content, share knowledge, impart experience, and crowdsource learning resource requests and contributions. In papers [4] and [5], we came to know that social coding sites (such as GitHub, Bitbucket, etc.) offer various features to support crowd-sourced software engineering, such as forking and sending pull requests. When you use these features, a lot of information about your behavior is recorded. The main goal should be to develop an approach based on user behavior data and to recommend relevant open source projects to developers, which can aid in activities such as finding the right open source solutions to quickly build prototypes. These papers investigate the potential of such a method by conducting a series of experiments on GitHub like website's data sets.

### III.METHODOLOGY

Hybrid Software Development Model: A combination of the Waterfall and Agile approaches

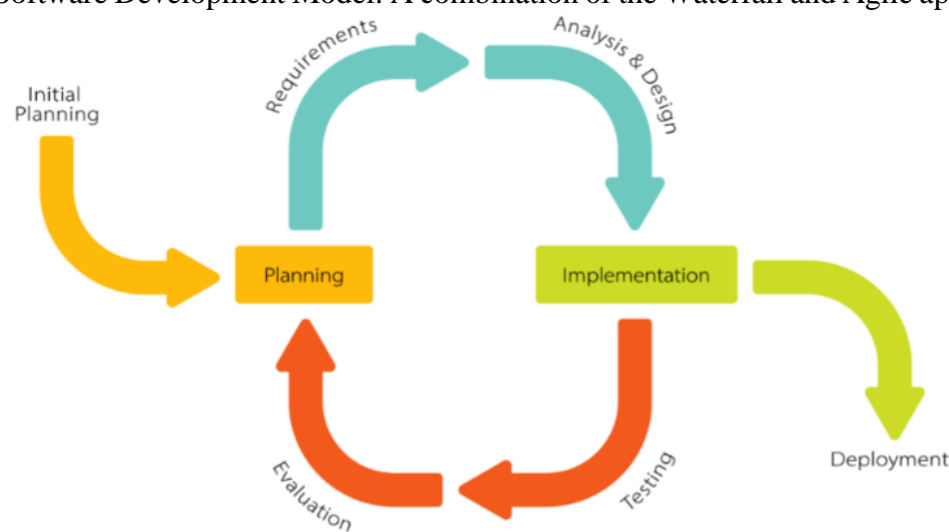


Fig. 1. DATA MODEL

A hybrid data model is the data model which we have used to implement our project. The reason to choose a hybrid data model is because of its flexibility. In the waterfall model, we get various opportunities for testing a project. Planning and testing are the only keys to having a successful project. waterfall models help a creator to have multiple tests of a task. multiple tasks help users to plan future tasks and risks at hand. If a certain stage is cleared and the next stage has risk in it, he can completely change the first test case and result to another intermediate test case in the next step. With this users can have multiple scenarios for every test case and can help them to choose the best sets of steps for their project.

The agile model ensures proper planning of the task that is required while making a project. Projects usually have a list of lengthy tasks to complete and have proper information's about which tasks are needed for the smooth completion of the project. Having unnecessary tasks can waste manpower and can also increase the time to complete the project.

All users MVC/MVT: Model-View-Controller/Template Since we are using an SSR (Server Side Rendering) application with MVC architecture, the following steps will be followed:

1. User requests a website.: What happens in this is that the user logs in to our website and the request is sent to the server. The data requested by the user is present in the server which takes time to fetch.
2. Server creates ready HTML files.: The time required to load that request by the user may vary. What MVC helps us in this is to create ready HTML files which are headers and footer of the main site. This is visible to the user until his request is accessed and processed.
3. Browser renders HTML, but it's not interactive: It is not a very interactive side of the webpage but is essential for the user. the main reason being essential is because it keeps users interacting with the webpage until their data is being fetched.
4. Browser downloads requested files: The server renders the data and the data file is sent to the user.
5. Browser executes requested files.

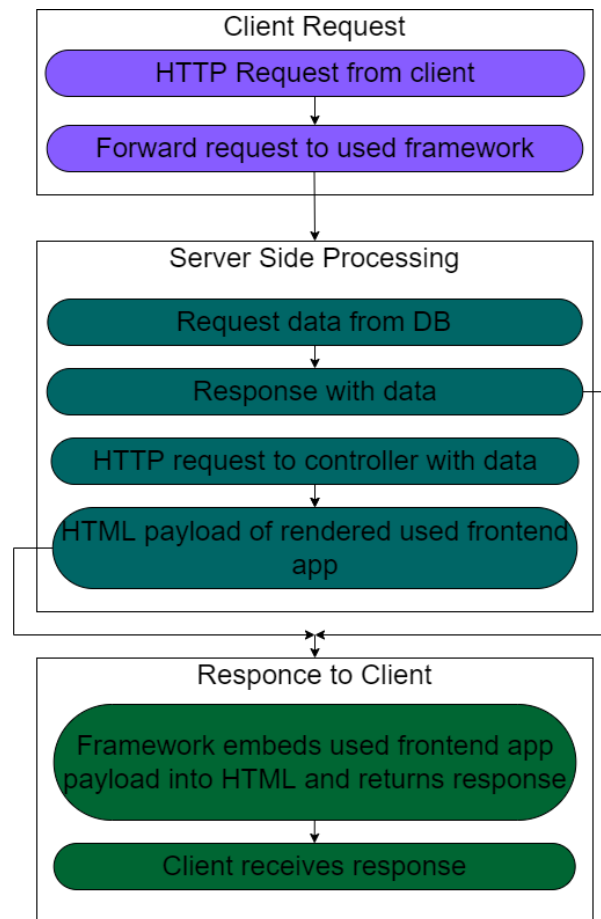


Fig. 2. SSR MODEL

There are 3 layers of model view and template which run independently but combine into a single output. All three of them have different tasks and responsibilities. Data information is represented as attributes and is present in the model. It has application logic and doesn't have control over other Django layers. It reads updates and deletes data in a database.

The second layer view has tasks like accepting HTTP requests and giving HTTP responses to the client. It takes data from a model and displays the data to the user.

Templates are data collections of HTML coding. It can either be static or dynamic. It only contains data and acts as a database to model. It has nothing to do with the business end of a model.

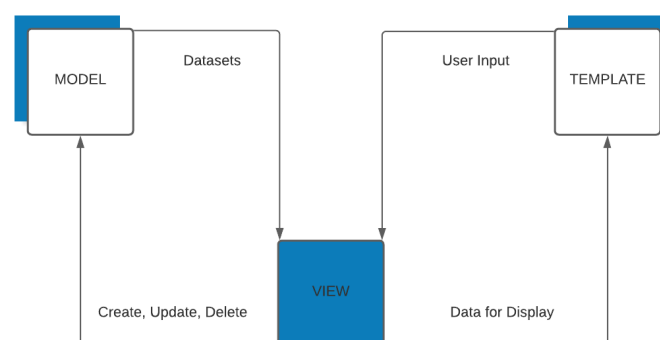


Fig. 3. MVC DIAGRAM

## IV.DESIGN AND IMPLEMENTATION

The working of the system will be demonstrated using the above-mentioned diagrams. So, if we combine Fig. 2 and Fig. 3, we will get a proper visualization of the final system workflow. Users will request the needed data by using the URLs. The used framework will request the same data using servers to contact other servers and collect the proper data from available servers. And then the main URLs will be resolved by which the discussed MVC architecture will take place for further processing. This is the most appropriate flow of the system for managing projects in a cloud-based system.

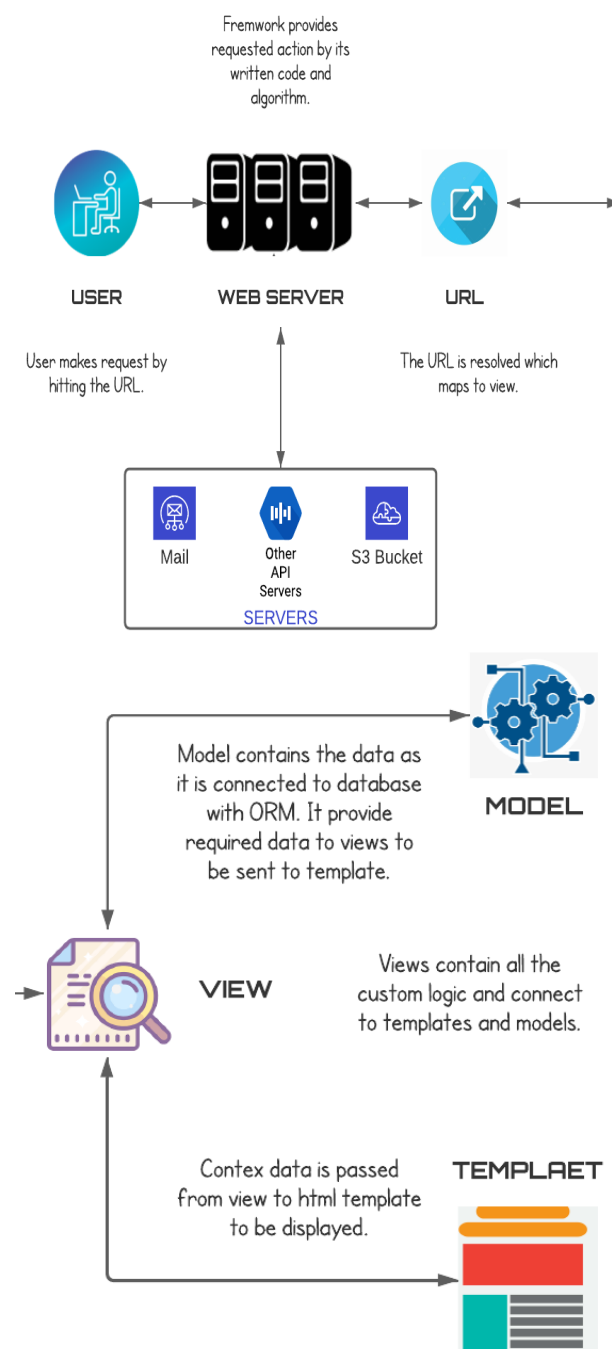


Fig.4. SYSTEM FLOW DIAGRAM

All users can have a login/register page and an account details page where they can see or can change their account details. A Home page where the list of all projects will be visible. On the website, projects will be available in batches wise like 2021, and 2022. In 2021 some projects were created, these projects will be available for the 2022 batch of students, and so on and some extra projects can be created too. These projects will be allocated to the students by the department project coordinator.

### **Amazon S3:**

Amazon S3(Amazon Simple Storage Service) is a virtual bucket where we store our data which we refer to as objects, it is an object storage service

S3 is frequently used because of the features it provides. Data scalability, availability security, and high-performance rate It also provides features like management of all the things by which we can optimize, organize, and configure all of our data for any type of business or organization. It deals with all types of users from small industries to large organizations, for example, backup and restores, all types of websites, data lakes, mobile applications, IOT devices, big data analytics, and much more.

We used S3 services to store our uploaded files and profile images and fetch it from S3 to show on the website. It works as shown in the following section.

To store our files in S3, we will first create a bucket and specify its name with the AWS region. Then, we will make some changes to the bucket policy and CORS to upload and fetch the data from our website. Each object has a key, which is the unique identifier for the object within the bucket.

Code and settings for cross-origin resource sharing:

```
[
  {
    "AllowedHeaders": [
      "*"
    ],
    "AllowedMethods": [
      "PUT",
      "POST",
      "DELETE"
    ],
    "AllowedOrigins": [
      "*"
    ],
    "ExposeHeaders": []
  }
]
```

Further, we have to declare where to store the files in s3 for that we will write code:  
from storages.backends.s3boto3 import S3Boto3Storage

```
class MediaStore(S3Boto3Storage):
    location = 'media'
    file_overwrite = False
```

### **Identity and Access Management:**

Identity and Access Management (IAM) provides control across all of AWS. When someone uses AWS services, there may be more users to control it. So, we use IAM for it by which we provide security to our account and give specific permissions to specific IAM users

And it's always recommended that we should not use the main user's private key to control AWS services. It is always safe to use different IAM users and give them policies to manage the services. In our case, we use the Amazon S3 bucket policy for an IAM user and call it from our website using env with proper details in it.

To connect with Django we have to use a storage library for it. And we have to write the following information's in the settings.py file

```
AWS_ACCESS_KEY_ID = 'IAM _ACCESS_KEY_ID'
AWS_SECRET_ACCESS_KEY = 'IAM AWS_SECRET_ACCESS_KEY'
AWS_STORAGE_BUCKET_NAME = 'Your bucket name'
AWS_S3_FILE_OVERWRITE = False
AWS_DEFAULT_ACL = None
DEFAULT_FILE_STORAGE = 'storages.backends.s3boto3.S3Boto3Storage'
AWS_S3_REGION_NAME = 'us-east-2' #bucket REGION_NAME
AWS_S3_SIGNATURE_VERSION = 's3v4'
```

### **Heroku:**

Heroku is a free PaaS (Platform as a Service) for developers. It is a container-based cloud platform. It is more flexible, and easy to use so that the developers can easily host their apps in the market. The developers do have not to worry about maintaining servers, hardware, or infrastructure. So, we used Heroku to host our website.

To host on Heroku its compulsory to make a Procfile in the repository and we will write: "web:gunicorn project.wsgi" by which we can write commands in Heroku bash or terminal to migrate and create super users in it and also we can further make migrations to it and change the website if needed. The commands for the above operations are:

```
python manage.py makemigrations to make migrations if made some changes to our model.
python manage.py migrate to make all databases migrate for the first time or after making migrations
python manage.py createsuperuser to create a super user.
```

### **PostgreSQL:**

As we know PostgreSQL is the most used database which handles a large amount of data and all the transaction-based works. In addition to being free, it is highly extensible with open-source object-relational database systems. For example, we can define our data types and functions, and we can write code using any programming language without recompiling our database.

In settings.py we have to specify the following things to make tables from models and fetch data from the created tables.



```

DATABASES={
  'default':{
    'ENGINE':'django.db.backends.postgresql_psycopg2',
    'NAME':'database_name',
    'USER':'postgres',
    'PASSWORD':'Password',
    'HOST':'localhost',
    'PORT':'5432',
  }
}

```

And to create models we can use any language one of them will follow code syntax like:

```

class Student(models.Model):
    user = models.OneToOneField(User, on_delete=models.CASCADE)
    student_id = models.CharField(max_length=20, default=' ')
    phone_number = models.CharField(max_length=20, default=' ')
    image = models.ImageField(default='user.png', upload_to='profile_pics/')
    batch = models.ForeignKey(Batch, on_delete=models.SET_NULL, null=True)
    department = models.ForeignKey(DepartmentName, on_delete=models.SET_NULL,
null=True)
    college = models.ForeignKey(CollegeName, on_delete=models.SET_NULL, null=True)
    div = models.ForeignKey(Division, on_delete=models.SET_NULL, null=True)
    project = models.ManyToManyField(Project, blank=True)

    class Meta:
        ordering = ['user']
    def __str__(self):
        return str(self.user)

```

### **SENDGRID:**

To use an SMTP mail server, it's always best to use a trusted third-party mailing system, by which without concern about the mail system we can focus on the main objective of our project. Here SendGrid provides a perfect user experience, security-enhanced, and fluent workflow for any type of website. We used the SendGrid SMTP mail server for our website to send emails for registration, and change passwords. Hence we can provide security to our users and our website as well.

The codes for use SendGrid in our website are:

```

EMAIL_BACKEND= 'django.core.mail.backends.smtp.EmailBackend'
EMAIL_HOST = 'smtp.sendgrid.net'
EMAIL_HOST_USER = 'apikey' //This is the exact value 'apikey'//
SENDGRID_API_KEY = 'SG.IlwNT1oKRHqCyUiV_LYsy9emXT5uePxyVUFy8'
EMAIL_HOST_PASSWORD = SENDGRID_API_KEY
EMAIL_PORT = 587
EMAIL_USE_TLS = True

```

**URLs:**

To handle all the URLs in website and for file access we will write this codes in settings

```
STATIC_URL = '/static/'
```

```
MEDIA_ROOT = os.path.join(BASE_DIR, 'media')
```

```
MEDIA_URL = '/media/'
```

```
STATIC_ROOT = os.path.join(BASE_DIR, 'static')
```

And we will make a urls.py file in project to handle all the navigations as follow:

```
urlpatterns = [
```

```
    path("", login.main, name='main'),
```

```
]
```

```
if settings.DEBUG:
```

```
    urlpatterns += static(settings.MEDIA_URL, document_root=settings.MEDIA_ROOT)
```

The main page contains information about the website. If the user is new to our website there are videos on how to use the website for a perfect start to their project managing journey. By clicking the register, it will navigate the user to a page where they can select any user type from the present options. They can select their user preference for instance if the user is a student, he/she will register as a student by giving information. After that, a confirmation mail will be sent to the user's mail id for security and authentication purposes. After the mail is verified, they can log in to the website and begin their work as the user-specified works are provided to them which are described below.

Brief about the project and managing it on the website:

The projects will be created by the project creator according to colleges, batches and departments present in that college. So, when the students want to enroll in a project, they could see only their college and department projects, which is better for all to access progress reports and manage all the details with proper information. One project cannot be assigned to another team at the same time. It can be assigned to another team after completing the duration of the project.

It will be done by clearing all the enrolment details and status entails. If the college wants its previous year's details it can access them by visiting the saved data page. Like this, all the data is saved in a different table and every year, all the projects will be managed with enrolment and status from a different table.

Users have the option to update their information. Sometimes in haste users can make some spelling mistakes or any other mistakes but there is an option to update information. Sometimes we users also add only essential data, an option to add other fields later is also available.

***Project Creator:***

After login, the Project creator will create a project which will be later allocated to the students by the department project coordinator.

The project creator will add tasks/issues for the respective project. It's designed in this way while adding the task to a project it is not necessary to add a project field to it the project field can be added by its id itself while adding a task to a specific project. The project creator can delete and update all the projects and the tasks present in them whenever he needs to do it.

The projects will be created according to colleges, batches, and departments present in it and durations will be given to it while enrolment of a project to the team.

#### *Guide:*

The guide will be allocated to a project by the department project coordinator. The guide will verify the uploaded solution and will guide the student for a better outcome.

The deadline for tasks will be created by a guide after getting assigned to him/her. We can say that after assigning a project to a guide, they will add a deadline for all the tasks.

The guide can also update the status of a task to working or approved mode according to the progress report. They also can chat with the students to guide them properly for a better outcome of the project.

It's always best for all, as to be guided and work in a friendly team environment. At some point in our life, we all experience that we give our best performance and use maximum effort when all of our work together with proper guidance.

#### *Student:*

After login in for the first-time students will form a team on the website by their leader or by themselves. They can't create another team with the same team name if it's already been created.

Once the team is created the projects will be visible to all the students who are part of that particular team. The Leader will request the project from the list of projects available.

After the allocation of projects by the project coordinator, students will see the assigned project. After clicking the view-project they will navigate to the main project page where they will get tasks/issues available in that project.

There is also an option to ask doubts about the tasks present in the project to guide or industry mentors assigned to them.

Students will solve the tasks/issues and after solving they can upload their files and codes for verification by the guide or industry mentor and can later view the uploaded files in the status section. The status of the project and task if it is done or rejected will be visible to students on the same page. On the main page, the overall progress of the project is also visible to students and guides who are part of that particular project.

#### *Head of Department:*

The Head of the Department can view all the details of a project like details of members working on the project. Guide allocated/selected for the projects and can also view how much progress is made by the group. They can view total interactions made by the users (students or guides). So, they can approach any of the team members or guides to give them some advice if the team is lacking.

#### *Industry Mentor:*

They have the same access as a guide. Industry mentors will be assigned to final year students as we know they have more experience and they will be perfect examples to guide the next

generation of our world to pass them the best knowledge they have. In this way, our surroundings will be in safe hands with a more accurate and better knowledge to lead the world to a better future. They also have options like guide to approve and reject the submitted tasks. The final verification of a task will be done by Industry Mentors.

#### *Department Project Coordinator:*

The department project coordinator has a major role. They will have most of the controls to work on. The coordinator is the main user as they have to manage all the details of the project.

They will have access to allocate students, guides, and Industry Mentor to a project, and examine whether everything is going smoothly or not.

There will be features to assign projects to any team by the coordinator. If any project is requested by the students, it can also be assigned by the Department project coordinator. There is nothing to worry about how the backend works in this project assigning process by the user. Everything is properly visible and understandable to the coordinator to handle these things. As our website is made in such a way that all the backend works and project assigning details are taken care of. They can view all the reports batch-wise and how much progress is made in a particular batch or a particular project in their department.

## **V. CONCLUSION**

The Project Management system is a very important tool in recent times. The number of projects and the number of teams that are performing this project is increasing with time. As the number of projects increases the number of tasks also increases which results in increased paperwork. Tools like project management systems can therefore help in reducing those paper works and help users to store a lot of data into a single system which will later help them to access all the data in one single place.

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